Chopper-Chopping Component of Palaeolithic India

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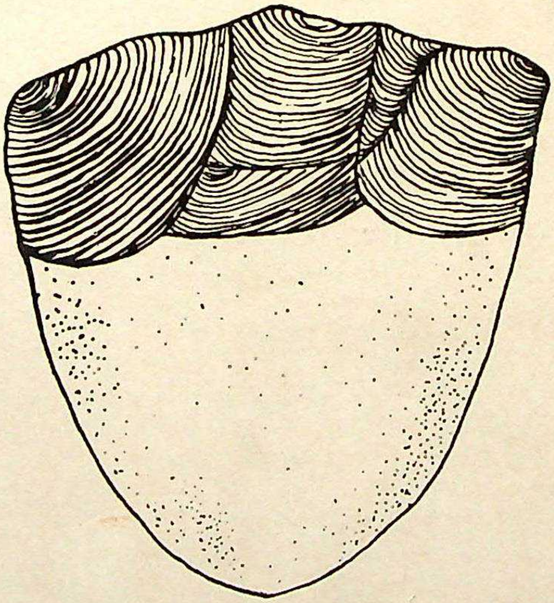

VIDULA JAYASWAL

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CHOPPER-CHOPPING
COMPONENT
OF PALAEOLITHIC INDIA

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VIDULA JAYASWAL

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Vidula Jayaswal

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On the Occassion of
the birth centenary
of my grandfather

(Late) Dr K. P. JAYASWAL

This book is dedicated to his sacred memory

The picture of the Palaeolithic culture-stages is quite different in other areas, largely because of a wide ranging detailed analyses of the collections. For instance, it has been shown that a much smaller area of France, retains evidence for various stages of lithic technology, and also has a number of cultural-traits within a short duration (Mousterian facies of the early Wurm Glaciation). These examples highlight the contrasting position of the Indian Palaeolithic picture, where the huge landmass is characterized by the prevalence of one or two general traits with no sharp typological and or technological variations and changes, within the three phases. Some of the obvious reasons for this situation, to my mind, is the lack of proper investigations of the archaeological data on our part. It is not difficult to comprehend that, France would never had such a fine division of cultures of the last Glaciation, had Bordes and others in Europe not realized the immense possibility of typo-technological study of the tool-kits. If European Prehistory could derive benefit from the penetrating investigations of Bordes and others, why could we not subject the Indian Palaeolithic industries to similar analyses. There is yet another valid reason for undertaking such a study. The Indian Palaeolithic scene is not likely to be enriched by a correlation of climatic fluctuations or cultural variation as was the case in European Prehistory. Attention has, therefore to be focused on techno-typological study of the tool-kits of the Palaeolithic industries of the Indian sub-continent. I am convinced that this line of enquiry holds the promise of unfolding the details of variation in what has been generally regarded as homogenous group. The present study has been undertaken to assess the potentiality of this mode of enquiry. As a kind of pilot project chopper-chopping tools have been selected for a detailed analysis, which forms the main theme of the present monograph. The basic tool for this investigation is the statistical counts of the typological and technological features of the concerned tool-kits in detail. Besides examining the issues related to the chopper-chopping complex, it is also intended to propose certain norms for typological studies, which are not popular enough here, but, can be fruitfully applied extensively for unvailing the cultural contents.

I am grateful to various scholars who have given their collections to me for first hand study. In this regard I wish to put to record my gratitude to Professors R.V. Joshi, V.N. Misra, Drs K. Paddayya, M.L.K. Murty, R.S. Pappu, J. Armand and Statira Guzder of Deccan College, Pune; Dr K.D. Banerjee of the Prehistory Branch of the Archaeological Survey of India; and, Dr P.C. Pant of the Banaras Hindu University. My thanks are also due to the Director General of the Archaeological Survey of India, and Shri R.P. Sharma to give me facilities to study the Safdarjung Collections of the Archaeological Survey of India.

My sincere thanks are due to Professor H. de Lumley, who initiated the idea to work on the chopper-chopping tools of India, and also supplied to me relevant literature on similar studies, which are carried out in France, in the recent years.

Preface

After the initial recognition of the Old Stone Age remains in India by Foote in the year 1863, the primary task before the India prehistorians was to accumulate the remains, in great quantities, of the Palaeolithic cultures in its proper geological context. This was achieved by initiating regional surveys by various centres of archaeology, such as the Deccan College, Poona; the Universities of Calcutta, Allahabad, Banaras, Chandigarh etc., and the Archaeological Survey of India. River valleys received particular attention in this scheme, since they seemed to retain evidence for palaeo-climate, as well as, clues for assigning chronology to the lithic assemblages. As a result of these surveys, the remains of the Palaeolithic man are now reported from almost every part of this sub-continent. Besides, these explorations also brought to light evidence for the existence of each of the three Palaeolithic phases. For instance, the Middle Palaeolithic or the Middle Stone Age was recognized by H.D. Sankalia, at Nevasa, and the Upper Palaeolithic in the Belan valley by G.R. Sharma. Thus, we have now in hand good amount of archaeological data of the Pleistocene epoch, in this part too.

In spite of all this, there are many fundamental quarries about the Palaeolithic cultures which remain unanswered. This is because the treatment given to the archaeological data is of very general nature. The common practice is to scrutinize the tool-kits within five or six broad typological units, and, in accordance with the overwhelming traits, assign them to one of the three phases. For example, the occurrence of chopper-chopping, handaxe and cleaver represent the existence of the Lower Palaeolithic stage in the area, while scrapers, points and borers form the bulk of the Middle Palaeolithic. Similarly, the Upper Palaeolithic is recognized by the appearance of blade tools and burins in good proportion. Though essential as the intial step for the comprehension of the field data, it can hardly substitute the detailed scientific analyses of the tool-kits, which is inevitable for the fuller understanding of the Stone Age cultural remains. The purposeful exploitation of the typo-technological analyses is more or less unattempted on the Indian Palaeolithic collections. Thus, the Palaeolithic stages of this sub-continent are marked by a few general characteristics of vague nature.

5. Core—Levallois
6. Core—Levallois

FIGURE 13

BARIARPUR—Chopper-chopping element associating the Acheulians
1. Chopping tool—Convex edge, Wide straight butt
2. By-product flake of II series
3. Core—Pebble
4. Chopper—Pointed edge, Round butt
5. By-product flake of I series

FIGURE 14

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1. Chopping tool—Convex edge, Round butt
2. Chopper—Convex edge, Round butt
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3. Handaxe
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5. Chopping tool—Straight edge, Pointed butt
6. Chopping tool—Pointed edge, Pointed butt

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1. Chopper—Convex edge, Pointed butt
2. Atypical chopping tool—Straight edge, Pointed butt
3. Flake—Levallois
4. Chopper—Straight edge, Round butt
5. By-product flake of II series
6. By-product flake of gleichgerichete bearbeitung
7. Flake—Levallois
8. Blade—Levallois (broken)
9. Atypical chopping tool—Convex edge, Round butt

FIGURE 17

DURKADI—Chopper-chopping element associating the Acheulians

1. Chopping tool—Convex edge, Small straight butt
2. Chopping tool—*Zig*-zag edge, Pointed butt
3. Chopper—Pointed edge, Straight butt
4. Chopping tool—Denticulated edge, Pointed butt

FIGURE 18

ANAGWADI—Chopper-chopping element associating the Acheulians

1. Chopping tool—Convex edge, Pointed butt
2. Chopping tool—*Zig*-zag edge, Pointed butt
3. Chopper—Notched edge, Small straight butt
4. Chopper—Peripheral, Straight butt
5. Chopping tool—Pointed edge, Round butt

FIGURE 19

HUNSGI—Chopper-chopping element associating the Acheulians

1. Chopper—Convex edge, Pointed butt
2. Atypical chopper—Notched edge, Straight butt
3. Atypical chopping tool—Convex edge, Straight butt
4. Chopper—Convex edge, Round butt

FIGURE 20

VEDULLACHERVU—Chopper-chopping element associating the Acheulians

1. Chopper—Denticulated edge, Pointed butt
2. By-product flake of I series
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4. Core—Pebble, Prepared dorsal

FIGURE 21

VADAMADURAI—Chopper-chopping element associating the Acheulians

1. Chopping tool--Denticulated edge, Pointed butt
2. Chopping tool—Zig-zag edge, Round butt
3. Chopper—Denticulated edge, Pointed butt
4. Chopping tool/core
5. Atypical chopper—Pointed edge, Straight butt
6. By-product flake of II series

FIGURE 22

VADAMADURAI—Chopper-chopping element associating the Acheulians

1. Chopping tool—Convex edge, Round butt
2. By-product flake of II Series
3. By-product flake or blade (broken) ?
4. By-product flake of III/IV series
5. By-product flake of II series
6. By-product flake of II/III series
7. Core—Pebble, Prepared dorsal and prepared striking platform
8. By-product flake of core dressing
9. Flake—Levallois

1

Introduction

Implements made on pebbles, cobbles and stone nodules, are one of the earliest creations of man. The archaic nature of these, particularly, the chopper-chopping forms, at times, put them closer in appearance to many such stone pieces which are the result of natural breakage. Thus, it took some time to realize the artefactual character of these. Instead, the comparatively sophisticated working on the Acheulian implements, namely handaxe, prompted the initial recognition of the early human skill on stone, both in France and India. Acheulian implements also emerged as the most prominent culture trait of the Lower Palaeolithic phase, due to their occurrence in great quantities in a wide area. But, as the evidence stands today, chopper-chopping too, has cropped up as one of the important typo-technological trait of the Lower Palaeolithic Phase A comprehensive picture of this trait includes the issues related to its stratigraphic and chronologic occurrences, distribution, contribution to the history of lithic technology, associated human forms etc. A brief account of these is mentioned below.

I

Chopper-chopping in global context have three modes of occurrences. These are—(i) The pre-Acheulian appearance; (ii) Independent existence for a long period; and, (iii) Association with the Acheulians. All the three have different distribution pattern and chronological positions.

(i) The first instance, though sporadic in nature is significant for its earliest stratigraphic appearance in the cultural history of the mankind. In parts of Africa and Europe, where it is well documented, it precedes the Acheulian stage. The evidence obtained from Olduvai Gorge in east Africa, and Le Vallonet in France are the well-known examples of this group. Excavations at Le Vallonet, by de Lumley and others, between 1959 and 1962, have brought to notice a small but significant assemblage of choppers and unretouched flakes. Along with these artefacts, a good amount of faunal remains was discovered (Lumley. 1976). The collection is given a rather early date, *i.e.*, early, part of Mindel Glaciation, on the basis of the faunal remains (Lumley. 1976). However, the recent discoveries by Viguier around Cadiz in south-east Spain, may perhaps push the antiquity of the chopper-chopping further. Because, the age assigned to this assemblage, which was obtained during the excavation of the site by Thibault and Santonza, is early part of the Gunz Glaciation (ref. Bhattacharya. 1977). These examples establish fairly early date for the chopper-chopping in the European continent. Since the Acheulian traces are absent in this stage, it is taken to precede the Acheulians. Though these finds could provide considerable old date to the chopper-chopping in Europe, they are at least about one million years later than the African evidence of the earliest assemblages.

The Lower and Middle Pleistocene compositions of the eastern branch of the Rift valley, in Tanzania (East Africa), has given one of the finest sequence of the lithic technology and the human evolution. This is the valley of Olduvai, which has received attention of the prehistorians since 1951. Leakey's painstaking investigation, here, showed that around 1.8 million years ago (K/A date), a pre-human species was exploiting pebbles and stone lumps in a rudimentary way (Leakey. 1965). The artefacts of this type comprised choppers, chopping tools and flakes, and were called Oldowan after the name of the area. The Oldowan industry in its initial stage is reported to be devoid of Acheulian traces. It was obtained from the Beds I and II (lower part of Bed II). These deposits are superimposed by a series of Acheulian levels in succession. There is, thus, evidence to suggest that the pre-Acheulian stage at Olduvai Gorge, the Oldowan culture, provided the basis for the development of Acheulian technology. Outside this valley, Oldowan is reported from Omo layers of South Ethiopia and Casablanca in Morocco. Similar discoveries from the other parts of Africa, such as the Sahara, are not so reliable, as they were obtained from the surface.

(ii) The second situation is illustrated by the wide spread of the chopper-chopping in Asia and also small pockets out side this continent. In Central and South-east Asia the area of dispersal of this trait forms a vast belt which runs from the Soviet Central Asia to China passing through Burma and Java (Fig. 1). It may be recalled that the north-western part of the Indo-Pakistan sub-continent, which is virtually treasure house of the chopper-chopping trait forms the southern fringes of this spread. However, their concentration in restricted areas can be seen in Europe in the form of Vértesszöllös and Buda industries. This group is later in date than the former. For instance, the Vértesszöllös group in Hungary, implies the existence of pebble based culture stage in Europe during Interstadial of the Mindel Glaciation (Kretzoi & Vértes.

1965). A later date for this industry is also corroborated by the typological features as, it seems to retain evoloved forms of the Oldowan types. The evidence for use of fire and the remains of *Pithecanthropus* from Vértesszöllös bring this group closer to the Asian belt rather than the African evidence.

Similarly, the Asian chopper-chopping belt is also later in age than the Oldowan and Vallonet. All the earlier industries in this part are either dated to the Second Glacial or the second pluvial cycle. But, in all probability the tradition continued to subsist the palaeolithic life upto the later stages of the Pleistocene epoch. In Burma, the Irawaddi valley provides evidence for the Anaythian, which developed in two stages between the second and the fourth pluvial cycles. There is no marked change in the typological character of tools of the Early and the Late Anyathian, accept for the flake detaching techniques, which are more refined in the later stage (Movius. 1948). The clues availed in the Potwar region of the Indo-Pakistan sub-continent are also somewhat similar. Here, chopper-chopping trait seems to continue from the second to the fourth glacial cycle in the form of the Soanian or Sohanian culture-development (Paterson & Drummond. 1962). The Choukoutien of China reveals a likewise trend. The chopper-chopping tradition in this area also starts from the second glaciation and continues till the fourth glaciation when it culminates into the Mousterian tradition of China.

(iii) The picture of chopper-chopping element is quite vague in the third situation where they are associated the fulfledged Acheulians. In the Acheulian tool-kits, both with regard to their quantity and also less impressive mode of working, chopper-chopping seem to occupy a subdued position. At times the quantitative and morphological data of this element lack details. Even in this subdued position, the chopper-chopping element seems to be having a long time-span, as well as wide area of distribution.

II

Since some of the groups of the chopper-chopping are regarded as the specimens of the earliest technology, related to these are the problems and issues of the earliest human forms and their bearing on the beginning of technological skill becomes quite relevant to the present theme. The indications from Olduvai Gorge are that, one or two of the sub-species of the *Australopithecines* were the makers of the Oldowan. From Bed I and the lower part of the Bed II, were obtained a number of hominid fossils belonging to the *Australopithecus* species (Leakey. 1951). Parallel to the lithic technological development from Oldowan to the developed form of the Acheulian, evolution of the hominid branch has varieties of *Australopithecines* and *Homo Erectus*, at this site. Oldowan after initiating Acheulian workmanship continued in the upper levels, so do the *Australopithecines*, which were found to be co-existing with the later species. Though it is difficult to name the specific members of *Australopithecines* as the maker of the Oldowan industry, the species in general can be credited for inventing the lithic technology. However, biologically these were not ahead of apes, and far behind the *Homo Sapiens*. Clark and Oakley's explanation seems to be plausible, that the simple morphology of the Oldowan tools hardly needed a long process of experimentation before hand (Clark. 1975; Oakley. 1957). This theoretical explanation is partly corroborated by recent experiments carried out by Wright on a young orangutan. Wright observed that, apes are biologically capable of learning stone breaking processes, and that *Australopithecines* were fully able to mastering the fundamentals of stone technology (Wright. 1978). Thus, in the present state of knowledge *Australopithecines* are taken to be the inventors of the lithic technology, and are also the earliest form of the man, as they were makers of culture.

It is not always that the Oldowan type of implements were made only by *Australopithecines*. This is because the distribution of this species is not in complete accordance with the distribution of the chopper-chopping trait. To quote a few examples, in South Africa a good amount of fossils of *Australopithecines* has been procurred, but these are not associated with Oldowan type of tools, or for that matter with any form of artefacts. Besides, Oldowan type of implements have been reported from certain parts of North Africa, but, these are unassociated with any type of hominid remains. Outside Africa this kind of association is completely absent. Thus, at Vallonet, though chopper-chopping of considerable antiquity were obtained, there is an absence of hominid fossil. The later industry of Vértesszöllös is associated with *Homo Erectus*, a much later species than the *Australopithecines*. Similarly, the Asian chopper-chopping belt is also associated with the *Homo Erectus* finds. At Choukoutien, near Pekin, the authors of chopper-chopping are the *Pithecanthropus*, which is a form of *Homo Erectus*. Existence of *Australopithecines* though is evidenced in this part, their tool making capability is not firmy established. As in no case they are associated with the implements.

On the basis of the facts described above, the general view is that the invention of the lithic technology in the form of Oldowan took place in the East Africa by some *Australopithecines* genius. Once invented, it spread fast to the other parts. This spread was primarily in two directions *i.e.*, to the European continent and to the Asian continent (Bordes. 1968 : 49). But, one may not rule out the possibility for an independent invention of tool technology in more than one area. For instance, the evidence of Le Vallonet has often been interpreted in terms of a northern expansion of the Oldowan (Coles & Higgs. 1969), but, it can as well be taken to represent an independently evolved group. It has to be borne in mind that the initial technological process governed by the physical capabilities will start from the chopper-chopping stage alone. Lack of hominid form at Le Vallonet, however, leaves these explanations rather unconfirmed.

The other branch which spreads towards the Asian continent, also present certain paradoxes. For instance, why did the rudimentary tool making tradition continue for such a long duration in this area? This becomes more conspicuous when one recalls the fact that, the *Homo Erectus* in other parts was efficiently making Acheulian tools, and also that the man on the Asian side was aware of this technological process. The second statement is illustrative by the fact that Acheulian, though in limited number has been reported from the heart of the chopper-chopping areas also, *i.e.*, China and north-west of the Indo-Pakistan sub-continent.

It is, thus, difficult to explain the fact that though the Lower Palaeolithic man in the region was aware of the Acheulian technique, yet he was unable or disinclined to exploit fully the potentiality of this rich tool making tradition. One probable reason could be ecological compulsions. But, this presumption would need further elaboration.

III

Two of the three modes of chopper-chopping occurrences are well documented in the Indian sub-continent. The evidence for the first situation, where they occur as pre-Acheulian stage, is though claimed at times, cannot be accepted without reservations. Two such claims are made from Madhya Pradesh. While surveying Narmada basin, Khatri recognized a pre-Acheulian assemblage at Mahadeo-Piparia, which he thought to be the progenitor of the Acheulian facies (Khatri. 1963). Khatri's claims were contradicted by Supekar, who later investigated the same area (Supekar. 1968). But, recently, Armand working around Maheshwar, in the vicinity, has also come up with a suggestion similar to that of Khatri (Armand. 1980). Besides, in one of the rock-shelters at Bhimbetka, not far from the Narmada basin, Wakankar too has procurred an exclusively chopper-chopping yielding deposit, which underlies the Acheulian floors (Wakankar. 1973). All these need further confirmation, before they can be grouped under the first situation.

The second situation is represented in the north-western part of the sub-continent, which enshrines a number of chopper-chopping locales. In spite of a few Acheulian sites, the main occupational area of chopper-chopping, remains uneffected from the Acheulians, (Paterson & Drummond. 1962). Thus, the evidence, here, is in correspondance with the similar evidence from China and Burma. However, our area of study is devoid of human fossils.

The peninsular India, which is the home of the Acheulian culture, also retains chopper-chopping element in varying proportions. Thus, it illustrates the afore discussed third situation, where chopper-chopping is associated with the Acheulians. There are, however, a few exclusively chopper-chopping pockets in the Peninsula, which are completely devoid of the Acheulian element. Noteworthy among these are the Lahchura group of industries, in the Betwa valley (Pant. 1965) and Nittur in Mysore (Ansari. 1970).

The concentration of chopper-chopping yielding locales in the north and the north-west, and that of the Acheulian in the Peninsula provided the main basis for the theory of two culture-groups within the Lower Palaeolithic phase of the Indo-Pakistan sub-continent (Krishnaswami. 1947). The reason for this culture-dichotomy was believed to be the independent survival of two groups of people namely, the handaxe making population of the Madras region, and, the chopper-chopping makers of the Soan region. It was further suggested that these two perhaps lived in isolation for some time, and, in due course, came into contact with each other, in and around the area of Singrauli basin (Krishnaswami & Soundara Rajan. 1951). About a decade later, the investigations in the Potwar region by Paterson and Drummond brought to light some isolated pockets of handaxe yielding localities, which is situated amidst chopper-chopping cluster. The investigators interpreted these sporadic occurrences in terms of the 'Stellenbosch invasion or intrusion in the area of Soanian' (Paterson & Drummond. 1962 : 95-101). It may, however, be recalled that de Terra and Paterson, also had noticed some of these localities in the earlier survey of the area (de Terra & Paterson. 1939 : 301) but, the finds remained unnoticed. Similarly the area of Acheulian, the Peninsula, also shows adiquate presence of chopper-chopping. It is some what surprising how this was missed by Krishnaswami, who had earlier investigated Kortalayar basin, near Madras. However, the controversy regarding the existence of two cultures persisted for quite some time (Misra & Mate. 1965), but, was forgotten after some time. Some of the later publications, however, occassionally re-opened the issue, but, could hardly add substantially to the existing knowledge and controversy (Varma. 1975).

So far only two main groups, as detailed above, had been recognized, but, while examining the technological features of the Lower Palaeolithic industries, the present author noticed more than two typo-technological groups (Jayaswal. 1973). The fluctuating frequencies of chopper-chopping and handaxe and cleaver provided the basis for such a grouping. These comprised — (i) the isolated chopper-chopping industries; (ii) the ones with predominating position of the chopper-chopping and the subordination of the biface implements, (iii) the predominantly Acheulian industries with lower proportion of chopper-chopping, and (iv) such Acheulian industries where cleaver emerges as the most prominent type (Jayaswal. 1973; 1978). These facts give rise to a number of enquiries such as, whether chopper-chopping persisted in Old Stone Age of this area, as a distinct culture-trait? It will be essential to see if the general morphological resemblance of the two reveals certain technological variations, when worked at micro-level. It may be worthwhile to investigate, the nature quantum of the uniformity and divergence of the above noted groups. Similarly, another field of enquiry could be whether the chopper-chopping element as integral part of Acheulians, was required to fulfil a need, which could not be accomplished by the sophisticated group of Acheulian fossil types, or was the chopper-chopping a mere survival of the earlier invented forms? These inquiries are also likely to provide clues to ascertain more complicated issues, like establishing or otherwise any kind of genetic relationship between the chopper-chopping and the Acheulian in this part too? Further, it may also be possible to explore the reasons for explaining the isolation of chopper-chopping, in terms of ecological niches. Some of these inquiries have been attempted in the present work.

The theme of the present volume is discussed within four sections. The actual analysis of the data succeeds the short account of the methodology and terminologies applied here. Chapters III and IV embody descriptions on location, stratigraphy, as well as, typo-technological details of each of the chopper-chopping finds of this subcontinent. These descriptions are screened within two compartments *i.e.*, the exclusively chopper-chopping localities, and, the chopper-chopping associating the Acheulian. Chapter V incorporates the comparative account of the classified data and interpretation of such technological features which emerged during the investigation.

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2

Terminology and Methodology

A sound methodology aided with the use of objective terminologies is imperative for any scientific study. These requirements also hold good for Stone Age studies. Unfortunately, in the publications on Indian Stone Age archaeology, most of the times, these are not well attended to. For instance, terms denoting artefact classes and technological processes are often ill-defined and at times remain ambiguous in nature. Another example is the shift from one to the other set of terms denoting periodization, which has created much confusion in course of the study of the Indian Stone Age cultures. It is, therefore, proposed to specify in the following lines, terminologies and nomenclatures, and, also the treatment given to the acquired data, adopted in this book.

The terms and nomenclatures used in Stone Age studies come under four major categories—(i) artefact classes, (ii) technological processes, (iii) cultures, and (iv) periods and sub-periods. The norms for application of all the four categories may not be the same. To illustrate, all the artefact classes such as, chopper, chopping tool, handaxe etc., and also the name of the technological processes like Mousterian, Levallois, Acheulian techniques etc., may not be placed by other terms in any situation. We have shown elsewhere, that the replacement of Levallois technique by 'Prepared Core technique' or 'Faceted Platform technique' in African and Indian studies, has added to the confusion, rather than clarifying the situation (Jayaswal. 1978). Thus, universal application of these terms is recommendable. Similar practice may also be adopted for the terms of the fourth category denoting the culture-stages at macro level, *i.e.*, Palaeolithic, Mesolithic and Neolithic. Our experience in the past has shown that the shift from this set to a number of others *viz.*, Early Stone Age, Middle Stone Age and Late Stone Age; Flake Culture, Flake-blade Culture and Core Culture etc., was not useful and, that the Palaeolithic-Mesolithic is the most practicable set for Indian conditions also. Contrary to the above named categories, the nomenclatures specifying culture/cultures need to be used with reservation, as in most cases, they are local phenomenon, with a restricted spatial distribution. Here we are referring to such culture-labels as 'Oldowan' and 'Soanian' etc., wherein caution is needed while making their application in the areas away from their well defined locales. Since most of these are local phenomenon, it will, however, be safe to refer to the morphological similarities between the two industries lying at a distance from one and other, in terms of typo-technological labels or traits. In the present case, it may be possible to indicate the scattered locales or isolated chopper-chopping assemblage by using 'chopper-chopping trait or element.'

Chopper-chopping trait has been frequently referred to as 'Pebble tool tradition/culture'. The present author too has used the latter term liberally in her earlier publications (Jayaswal. 1978 : 19). This is not a satisfactory situation for the simple reason that, the terms 'Chopper-chopping' and 'Pebble-tool' are not inter changable. There are instances wherein chopper-chopping tools were made on materials other than pebbles *e.g.*, in the Patjitian culture of Java and Anythian cultutre of Burma, fossil wood, silicified tuff and volcanic rock lumps are used in great quantities for making tools of this category (Movius. 1949 : 352-376). Similarly, not all pebble-tools can be said to belong to the category of chopper-chopping, as is the case of scraper on pebble, which is present in good number in the Acheulian industries of peninsular Indian complex. Thus, it was realized that the nature of raw materials used for making certain artefacts can hardly provide a substantial base for nomenclature of a typo-technological class.

Besides the above mentioned reasons, there is yet another advantage in dropping of the term 'Pebble tool', from the usage. As this will also help in putting aside the controversy of the nomenclature based on the specification of size of the water-rolled stones. For instance, following the details of the sedimentological chart, Mohapatra prefers to use 'Cobble' instead of 'Pebble' for the raw material used in his area, for making chopper and chopping tools (Mohapatra. 1980). But, similar specimens are referred to as pebbles by others (Lal. 1956 : 58-92). Under the circumstances, the present author favours the use of the term chopper-chopping and not the others.

II

The tool-kits in our analysis, at first, are classified within four major groups *i.e.*, Finished tools, Flakes, Cores and Diverses. Each of the first three, thereafter, is analysed into various classes on the basis of the typo-technological counts. Since the explanation of the major classes and also most of the sub-classes of finished tools, flakes and cores is also provided in our earlier publication (Jayaswal. 1978 : 10-19), our discussion here concentrates primarily on the artefact classes and processes associated with the chopper-chopping trait. The details of these were, however, skipped earlier, since the work did not have direct bearing on the theme under study and concentrated primarily on the technological details of the palaeolithic collections.

The localities yielding exclusively chopper-chopping collections consist simpler and limited typo-technological forms than the full-fledged Acheulian industries. Besides the fossil-implement-types like, chopper and chopping tools, which form the main bulk, there are also a few simple-side scrapers on flakes. The flakes and cores found in association are indicative of simpler techniques, such as Block-on-block etc. The important artefact classes, which need elaboration are described below.

CHOPPER

The first scientific definition given to this category is by Movius, who describes a chopper as a thick massive unifacially worked scraper (Movius. 1949). "This type of unifacial tool" ......, according to him...... "normally has a round, semi-oval, or almost straight cutting edge, formed by the removal of flakes from the upper surface of the implement only. The cutting edge may be either along the side or across the end of the specimen". He further adds,...... "In certain instances, however, limited flaking is present on the lower surface, but, in most cases this appears to be the result of use. Although many of the implements in this category are core tools made either on pebbles or angular chunks or rocks, examples manufactured from large flakes are quite common"......(Movius. 1949 : 350).

This definition lacks percision at two points. Firstly, size is taken to be the basic criterion for distinguishing a chopper from a scraper. But, specification of the size-range and the demarcating line of the two categories is not mentioned by Movius or the later works, which complicates a sound typo-technological classification. For instance, there are assemblages like Choukoutien, Vértesszöllös, Late Soan, etc., wherein small choppers are abundant. Except for the reduction of size all the other characteristics of the specimens in these follow the features of choppers. Similarly, in some of the early palaeolithic industries scrapers made on massive flakes can hardly be named as choppers, since their morphology is more akin to the scrapers. It is, thus, not sufficient to state that massive specimens are choppers and the smaller ones scrapers. It is the dimensional ratios which is an importont count for the two classes. Because, for choppers concentration of mass throughout the body of the specimen is a general requirement. Due to this factor, the ratio between the thickness and the longer axis of the typical specimens is not usually as great as a typical scraper. Scrapers either made on flake or core may at times have bigger length/breadth axes than that of choppers, but are thinner than the latter. Our counts suggest a ratio-range of the thickness : length=1 : 1.0 to 4.0, for typical choppers. We further propose that, the specimens having less thickness than the lower point of the ratio-range may be classified under scrapers. Besides the dimension of core, the nature of working on chopper and scraper also differs. The flaking on chopper extends more towards the body as against the scrapers, in which secondary working is not only closer to the margin, but is also smaller and shallower.

The present author, however, is unable to appreciate the use of 'chopper/scraper' or scraper synonym to chopper, which is at times found in some of the publications (Misra. 1967 : 26). For, both of these are basically two different categories and do not justify a mixing up. It is also difficult to agree with the suggestion that besides size, function should also be taken into account for distinguishing choppers from scrapers (Sen. 1957 : 157-159). As we have shown later, the possibility of certain forms of choppres used as scrapers is though plausible, yet it would be desirable to stick to the typo-technological counts first, rather than mixing these with the functional basis.

The second point in the definition of Movius requiring our attention is that, at one hand he emphasizes the unifacial working as an important characteristic for choppers, on the other hand he also refers to such specimens as choppers, which also have a little working on the lower surface. In our classification only unifacial specimens are grouped under choppers. Since the chopping tool also has a specific type of bifacial working, such specimens have not been included under this head. We prefer to group them separately under chopper/chopping label, leaving the door open for their grouping into either of the two.

The choppers, which are unifacially worked implements with a thick body, have a number of forms. On the basis of the nature of the working edge and also the form of butt, it is possible to divide them in quite a few sub-classes.

For a detailed study of the tool, it is essential to have fix points. First requirement in this regard is to have a definite orientation of the artefact under study. To avoid uncertainity, the criterion for the set orientation of chopper is the working edge, which is invariably placed towards top or north (Fig. 2). We fail to find enough justification for the suggested classification of chopper-chopping tools on the length and width of pebbles or cobbles (Leakey. 1971 : 4). With working edge at the top and the butt lying opposite it, we have taken into account the extent and the form of the working edge, form of the butt etc., for detail investigation of this tool type.

(1) *Single stroked chopper*

The working edge produced in this case is the result of the detachment of a big, deep flake. Edge form is generally concave and rarely straight.

(2) *Lateral chopper*

The working edge in this case is wider than the length of the artefact. Longer axis of the specimen is converted into a working edge. The group at times, has been referred to as 'Side chopper' (Leakey. 1971). On the basis of the form of the edge the group is further devisible within the following types (Pant. 1977).

i. Convex edged

ii. Concave edged

iii. Concavo-convex edged

iv. Straight edged

v. Denticulated

(3) *Chopper with narrow edge*

The working edge in this case is at the short axis of the elongated pebbles. Thus, the type is similar to the 'End-chopper uniface' of some scholars (Leakey. 1971). This group can also be divided according to the form of the edge.

i. Convex edged

ii. Concave edged

iii. Straight edged

vi. Denticulated

(4) *Pointed chopper*

The specimens are made generally on long pebble/cobble in this category. The working on the two sides converge into a point opposite to the butt. The form is also recognized by M.D. Leakey, who refers to the steep trimming on the specimen, as one of the cheif features (Leakey. 1971 : 4).

(5) *Two edged chopper*

We have adoped this term after M.D. Leakey, who describes the type as having two parallel longitudinal sides (more or less) parallel to the longer axis. She notices these, both in unifacial and bifacial specimens (Leakey. 1971 : 4).

(6) *Circumferential or peripheral chopper*

This term is also used after Leakey, who describes the specimens of this category, having working edge around the entire circumference or more than half of the circumference of the roughly rounded pebbles (Leakey. 1971 : 4).

(7) *Chopper with blunted edge*

The specimen of this group has high angle working at more than 80° angle, which result in blunting of the edge. Such a form has been named *Chopper a front abrupt*, by some of the French Prehistorians (Collina-Girarg).

Besides the nature of working edge, the form of butt, which generally depends on the form of the raw material, can be useful for cultural reconstruction. As per our observations, the following forms are commonlly found in Indian choppers.

i. *Round butt* : Found mostly in the specimens having roughly equal length-breadth axes, round butted chopper is convenient to hold against the palm of one hand.

ii. *Wide butt* : The form is seen generally on broad specimens. In case of bigger specimens it does not provide good grip to one palm, and use by holding with both the hands is presumed.

iii. *Narrow, U shaped or pointed butt* : This form of butt provides satisfactory grip to the four fingers and thumb.

Besides the mentioned counts, the form of raw material *i.e.*, natural flat base, intentional flat base and round pebbles are also taken note of.

CHOPPING TOOL

The following description given by Movius is fairly exhaustive and includes, by and large, all the main characteristics of a chopping tool. "These are core implements usually made on pebbles, or rough more or less tabular, chunks of silicified or similar rocks. They are bifacial artefacts in the sense that the cutting edge has been worked from both sides. In most cases, the edge thus produced is markedly sinuous, since it is normally worked by alternate flaking, or rather by the intersection of alternating flake scars. In other words, it is in the form of a broad W in the majority of instances", (Movius. 1949 : 350). It seems more logical to have chopping tool label instead of 'Bifacial chopper' (Joshi. 1972 : 43-46; Leakey. 1971), since, the mode of working on chopper and chopping tools are not exactly alike.

The placement of chopping tool for further typological counts is same as is suggested for chopper (Fig. 2). Further classification of this group with a few additions, is more or less similar to the earlier one.

(1) *Chopping tool with alternate working*

These are the typical forms, which have wavy or zig-zag working edge.

(2) *Lateral chopping tool*

- i. Convex edged
- ii. Concave edged
- iii. Straight edged

(3) *Chopping tool with narrow edged*

- i. Convex edged
- ii. Concave edged
- iii. Straight edged

(4) *Pointed chopping tool*

(5) *Two edged chopping tool*

(6) *Circumferential or peripheral chopping tool*

To the best of our knowledge, so far the most detailed anylysis of the Indian chopper-chopping assemblages has been done by Paterson (De Terra & Paterson. 1939 : 305-306) and Paterson with Drummond on Soan collections (Paterson & Drummond. 1962 : 54-58). It is desireable to review these sets of morphological categories, here, and fit these in our set of grouping of the chopper-chopping and other types made on pebbles.

The primary classification of implements from Potwar region is within two groups *i.e.*, 'Flat-based' pebble tools and 'Rounded-pebble' tools (De Terra & Paterson. 1939 : 305-306). The flat-based specimens include both naturally flat and split based plain surface from which, ... "flakes are struck off steeply toward the upper rounded surface, resulting in strong working edges usually convex, some times straight, never concave" ... (De Terra & Paterson. 1939 : 305-306). Paterson notices four types in this group. His Type (i) and (ii) are choppers with short convex working edge and wide straight working edge, respectively (De Terra & Paterson. 1939 : Pl. XXXIV, 4,1.). Type (iii), of the flat-based differs from the earlier two only marginally. The basic difference is the high angle flaking of the edges (De Terra & Paterson. 1939 : Pl. XXXIV, 2,3). This can be taken to be a chopper with steep working edge. Type (iv) of the flat-based group, has an artificial flat-base which, ... "may be formed by one large or two smaller flake scars and the upper surface is high and rounded. At one end, two or three flakes are struck upwards from the flat under-surface at angels of 50° to 80°, forming a sort of short chopping edge" (Paterson in De Terra & Paterson. 1939 : 306). The illustrated specimen of the type looks more a core than a chopper

(De Terra & Paterson. 1939 : Pl. XXXIV, 5). In our grouping, this type is mentioned chopper/core.

All the five categories of rounded pebble group are made on uncleaved pebble, and retain original pebble surface. Type (i) of this group is a chopping tool having alternate working at one of the sides of small spheroidal pebbles (De Terra & Paterson. 1939 : 306, Pl. XXXV, 1), while Type (ii) is made either on oval or circular pebble while has naturally flat surface. The low angle working *i.e.*, 20°-65°, on one surface makes it a chopper. A few of these have two working edges opposite each other (De Terra & Paterson. 1939 : 306). Type (iii) of the group is a chopping tool on elongated oval pebble, while Type (iv) is a pointed chopper (De Terra & Paterson. 1939 : 306) of our classification. The last type, which characterizes the later industries like Late Soan, is in fact a chopping tool with wide working edge. Made on roughly oval pebbles they have pebble butt and straight or convex edges. At times traces of secondary working on their edges can also be seen.

In the later study Paterson along with Drummond has analysed the artefacts made on pebbles of the Potwar region within three major and eight micro groups (Paterson & Drummond. 1962 : 54). The 'Flat-based' are the delibarately cleaved pebbles, while the Oblates' are the intact pebbles which are uncleaved. The group of 'Nucleates' include specimens which can be chopping tool or core. "The name nucleate is used because of the similarity of these tools to cores ......" (Paterson & Drummond. 1962 : 54). Most of the specimens of the Soan tool-kit are choppers. Soan types 1 to 3 are flat-bases. Description of Type 1, the 'Terminal flat-base', corresponds well with our chopper on split-base with narrow working edge (Paterson & Drummond. 1962 : 54). This type seems to consist of straight and convex edges. Soan Type 2, 'Unilateral flat-base', differs from the former as the working edge in this case is on longer axis (Paterson & Drummond. 1962 : 55).

'Bilateral flat-base' is also a split-based specimen worked unifacially all along the periphery. "This is similar to Type 2 but flaked along both sides, forming points at each end, the result being a distinctive "boat-shaped" artifact. Where the pebble is more spheroidal in shape, it is flaked all round the periphery and the result is blunted —cone in form" (Paterson & Drummond, 1962 : 55-56). The rounded pebble of the earlier publication, is now termed 'Oblate', 'Convex Oblate' (Soan Type 4) is again a flat-base variety, but now this surface is available in the original pebble form. The unifacial working on these is similar to choppers. The specimens have straight or convex edges (Paterson & Drummond. 1962 : 57). Soan Type 5 is pointed chopper of our classification, while the next type 'Unilateral Nucleate' could be chopping tool or core. For, the scholars describe this type having,... "undulating edge", which, "is confined to one side of the pebble". (Paterson & Drummond. 1962 : 58). 'Peripheral Nucleate', Type 7, looks closer to prepared core than a chopping tool (Paterson & Drummond. 1962 : 58; Fig. 17,7). The 'Turtle-back' is not a very familiar type. "A circular or oval oblate pebble is split in the equatorial plane and flakes struck off all round the periphery from the cortical across the cleavage surface. In a few cases there is a series of small scars round the edge of the cortical surface, forming a convenient platform for the major working on the opposite face. The final appearance of the artifacts is suggested in the name. The turtle-back may be a core for the production of small flakes, but whereas a core generally shows a wide range of scar sizes, here the range is small and size uniform. The equatorial working edge is therefore also regular" (Paterson & Drummond. 1962 : 58). We have preferred to classify such specimens under cores.

PSEUDO-CHOPPER/CHOPPING TOOL

In most of the collections of chopper-chopping, there are a few specimens which raise doubt about their artifactual nature. It was noticed by Bordes, that Riss moraine near Bourgen-Bresse, retained a group of specimens, which have a possibility to be produced by violent glacial action (Bordes. 1961 : 46). The nature of working on these specimens has both the possibilities, for natural flaking and the flaking by human hands. Thus, the unifacial specimens of this group may be termed as Pseudo-choppers, and the bifacial ones as pseudo-chopping tool. Though Bordes only refers to pointed specimens in this category (Bordes. 1961 : Pl. 41, No. 12, 14), but, the present author feels, that the term can incorporate other forms of the specimens also, which bear the aforesaid features. However, it is not safe to include the type in the statistical calculations of the well defined types.

The remaining finished tools referred to in the present volume are either well known, or have been explained in our earlier publication (Jayaswal. 1978 : 11-15).

FLAKE

Flake is defined by Movius as having..., "a length less than two times the width, the sides may or may not be essentially parallel. Regularity of thickness and form and complexity of the dorsal ridge pattern can vary greatly" (Movius. 1968 : 5). Analysing the technological trends of the Palaeolithic India, sub-classification of flakes and blades within fifteen types, using descriptive names was suggested by the present author (Jayaswal. 1978 : 15-17, Pl. II). This classification is based on the nature of the dorsal face and that of the striking platform. Intensive analysis of the collection in accordance with this set of terms is, thus, proposed for understanding the technological attainment of industries.

In case of chopper-chopping tool-kits the initial grouping of the flakes within intentionally detached and the by-products or waste-chips seemed useful. Though, it may not always be possible to separate them with certainity, we have suggested a workable way to do so, a little later in this chapter. By-product or waste-chip which is the result of fashioning of an implement and /or preparation of a core, can provide useful clues not only to understand the basic elements of an assemblage, but may also throw considerable light on the technological processes of implement types. For instance, a close view of the by-products during the manufacture of the chopper-chopping tools can determine the orientation of flaking, and order of their detachment etc. (Fig. 2).

CORE

Various grouping of this class is suggested by many of the scholars. Some of these classifications appear to be less scientific, because they lack clarity of definition (Paterson. 1945 : 1-19). For instance, at times it becomes difficult to distinguish one type from the other in the set proposed by Paterson, which was adopted by subsequent scholars of this sub-continent (Krishnaswami & Soundara Rajan. 1951 : 40-65). To avoid confusion, the present author prefers to have descriptive terms for cores also (Jayaswal. 1978 : 18). Similar to flakes the criterion for classification, in this case, too, is the nature of the dorsal face and the striking platform. However, for very distinct types such as Levallois core and bifacial discoidal core, we prefer to use the known terminology.

III

It would not be out of place to mention in brief the prevalent conventions for the names denoting technological processes. As argued elsewhere, terms tike Levallois, Mousterian, Acheulian etc., are to be used universally when the characteristic technological processes are present. In such cases, their change in different regions is not desirable, as it raises unnecessary controversy and confusion (Jayaswal. 1978 : 19). Thus, the use of terms like, Levallois, Mousterian, Acheulian techniques etc., can be made to have universal application. On the other hand there are few terms like 'Clactonian', which though is frequently used, is ambiguous in nature. A Clactonian flake is characterized by unprepared surface, massive size and wide angle (120°) between the striking platform and the ventral surface. They are said to be the result of 'Block-on-block technique', which is evident from the prominent cone of percussion borne by the specimens (Bordes. 1961 : 13). But in collections there may be a number of unsophisticated flakes, which are unprepared like Clactonian, but, are not characterised by other features mentioned above. Thus, a general category of unprepared flakes, may be said to include Clactonian flakes, unprepared flakes, the by-products or the primary dressing flakes.

The most frequent types of flakes and corresponding cores found in the chopper-chopping belong to the unprepared category and those with unprepared or partly prepared dorsal with unprepared and/or prepared striking platform. In the flakes of these categories four types were noticed.

(1) Clactonian flakes, which are characterised by massiveness and wide angle is reported from Potwar region (De Terra & Paterson. 1939), and Narmada valley (Khatri. 1963 : 186).

(2) Massive cleaver shaped flakes are associated with the Lower Palaeolithic industry of Nagarjunakonda. They are, probably, the only examples both in India and abroad (Pant & Jayaswal. 1971). Technologically they exhibit a very striking feature. Only boulders which showed curvatures of cleaver shape were selected for detaching these flakes. Thereafter, a single heavy blow at the centre of the curvature was found sufficient to produce a flake of the desired shape and size *i.e.*, a broad flake having a cleaver edge on one side. Though these were all detached by Block-on-block technique, they can hardly be grouped under Clactonian flakes, for their thick shape and size were predetermined at the detaching stage, a characteristic of the prepared flakes.

(3) The specimens of this category, the ordinary flakes, are of average size *i.e.*, these are smaller than the former two groups, but, are bigger than the dressing flakes. A good number of these are converted into finished tools with the help of secondary working.

(4) The fourth group consists of the by-products, which are frequently associated with chopper-chopping and Acheulian assemblages. The stone hammer, when ever applied for manufacturing crude implements like chopper and chopping tools, will produce a series of unprepared or partly dressed flakes (Fig. 3). In the industries where Acheulian implements are found in greater number, the flakes of this variety will be found in much lower proportion than the ones of '*gleischgerichetet bearbeitung*' (Bosinski. 1965 : 7), small Levallois like waste-products.

As mentioned earlier the grouping of flakes within the intentional and the by-product may be useful for cultural reconstruction. The separation of the two may not be easy in Acheulian industries, but, the situation is less complicated in collections of the chopper-chopping.

As the name suggests, a by-product or a waste-flake is a piece obtained during the manufacture of any artefact, such as, an implement or a prepared core. Thus, it is generally to the size and/or smaller than the biggest flake-scar appearing on the artefact. Besides, often they are manufactured accidentally and donot carry definite marks of preparation. The by-products of a chopper may be of three types :

(a) Entirely unprepared type which will be the primary dressing flake (Fig. 3).

(b) The ones with half cortexed and half flaked surface (Fig. 3).

(c) In case of the second series of working, comparatively smaller flakes with flaked dorsal surface may be present in the collection (Fig. 3). In the group of flakes they can be separated by applying statistical calculations on their length, breadth and thickness, which are described in the following lines.

IV

Application of simple statistical calculations, in most of the cases, help in separating the by-products from the planned flakes. The flake-scars on the finished implements and the preparatory scars on the cores may be measured. Keeping the suggested orientation in view (Fig. 2), maximum length and breadth of these may be measured. On the basis of these measurements a size-range for the by-products can be fixed up. Besides taking into account the size, the features in regard to the nature of the dorsal face and that of the striking platform of the by-products may also be taken note of. A check on this formula for classification can be made by working out the size-range and the morphological features of the planned flakes of the industry. In this case, prepared cores having the scar of a finally detached flakes and the well formed flakes converted into finished tools may provide fruitful guidelines. We are aware of the fact that there will be certain specimens in each collection showing features common to both the groups. These may, however, be mentioned separately for the time being. It may be remembered that each of the area and/or the collection will have to have its own size-range and feature-chart for both, the planned flakes and the by-products, which will not be applicable to the other. This is primarily, because, the raw material form, implement types, size of the artefacts and technological attainment vary from region to region.

Similarly, at times it may be difficult to separate a core on a pebble from that of a chopper and chopping tool. The size-range index of flake-scars compared to that of the actual flakes can be helpful in this case too. For instance, the size-indices of the intentionally detached flakes has to correspond with that of the scars on cores, and that of the by-products with the finished implements. Besides, the group of cores could be separated from the implements made on pebbles on the basis of mode of working on them. The angle and distribution pattern of the flake-scars on these specimens may indicate whether they were exploited for obtaining suitable flakes or whether they were chipped off to achieve a working edge.

The entire study here is based on simple statistical counts of the aforesaid features of the chopper-chopping and their associates in the palaeolithic collection of India. We are aware of the detailed studies of this element by others, who have also used computer for attribute analysis (Mohapatra. 1980), but we still have to see a fruitful result of such a detailed analysis.

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3

The Exclusively Chopper-Chopping Locales

As the present evidence stands, the exclusively chopper-chopping tool yielding sites cluster in and around the Potwar region of the north-western part of this subcontinent. The density of localities diminishes as one moves to the east and the south of the area of its concentration (Fig. 4). To the east, its limited distribution is in the form of sites which are located primarily in the valley of the rivers the Beas, the Banganga, the Sirsa, the Ravi etc. It's spread towards south is even much less pronounced. For instance, there are only a few locales of this category in the valley of the rivers the Betwa and the Ken, around Jhansi and Hamirpur, in Uttar Pradesh. Existence of separate chopper-chopping horizons in the valleys of the river Narmada and Bhimbetka, in Madhya Pradesh, have been claimed but not yet firmly established. Further south, in the Deccan, discoveries are made in Maharashtra, Konkan and Mysore. Nittur in Mysore is perhaps the southern most station of the exclusively chopping-chopper spread.

All the finds of the exclusively chopper-chopping group are described hereunder. To facilitate the account of these discoveries, it is proposed to divide the available data within the following regions :

I The Potwar

II The Northern India

III The Central India

IV The Deccan

I

THE POTWAR REGION

Lying within the boundaries of Pakistan, Potwar comprises plains formed by the Indus system. This north-western part of the Indo-Pakistan sub-continent,...... "is roughly bounded by the Indus in the west, the Jhelum and Poonch rivers to the east, the Pir Panjal foot hills in the north, and the Salt Range in the south, the town of Rawalpindi constituting the focal point" (Paterson & Drummond. 1962 : 11-12). Noteworthy sediment sequence of the area is seen in the form of the three stages of the Siwalik systems *i.e.*, the Lower, the Middle and the Upper Siwaliks. The Lower and the Middle Siwalik formations are the result of alluvium accumulation of the Pliocene epoch, while the Upper Siwalik system, comprising the Tatrot, the Pinjor and the Boulder conglomerate deposits, is the Pleistocene composition. It has been possible to correlate various stages of the Upper Siwalik system with the Pleistocene climatic cycle of the Himalayas. For instance, the Tatrot zone is said to have been formed during the first glacial cycle, while the Boulder conglomerate is the result of the out wash of the second glacial cycle of the mountains (Paterson & Drummond. 1962 : 12).

THE HISTORY OF RESEARCHES

The palaeolithic potentiality of the area was brought to light as early as 1928, by Wadia. Subsequently, Todd discovered a site near Rawalpindi in the year 1930 (Ref. Paterson & Drummond. 1962 : 7). A systematic survey of the area was conducted by a joint team sponsored by the Carnegie Institution of Washington, Yale University, Cambridge University, and the American Philosophical Society. Lead by De Terra, the team comprising Paterson, De Chardin and Drummond, studied the geomorphological and archaeological contents of the area in the year 1935. Details of this investigation are available in the form of two reports viz., *Studies on the Ice Age in India and Associated Human Cultures* (De Terra & Paterson. 1939), and *Soan the Palaeolithic of Pakistan* (Paterson & Drummond. 1962). The first publication elaborately describes the geomorphological features of the areas surveyed, wherein the archaeological finds are briefly touched. Contrary to this, a compressed account of the geomorphological features of the Potwar region is given in the second report, which emphasises the details of the cultural remains. A few surveys in the area were though carried out later also (Krantz. 1972), they lacked the thoroughness of the Yale-Cambridge Expedition.

PALAEO-CLIMATE

The Potwar climatic fluctuations of the Pleistocene epoch, are well documented in the Indus system. Though physiography of the area is closer to the Indo-Gangetic plains, its geological features are governed by the mountainous region of the Himalayas. For instance, the glaciations of the higher altitudes had considerable influence on the sediment sequence of this area. Besides, it has also been possible to establish relationship between the geological formations of these two areas. This has been possible through the correlation of the Himalayan morain formations with that of the Boulder conglomerate fan, Potwar loess and the river terraces of the Indus system (De Terra & Paterson. 1939 : 279-280).

In the valleys of the river Indus and its tributaries, particularly, the Soan or Sohan, the Middle and the Late Pleistocene formations are seen in the form of six terraces. The base for the said Pleistocene sediment-index is said to be provided by the Tatrot beds of the Lower Pleistocene times. The succession of four glaciations, namely from the second to the fifth glacial cycles, and also, the intermediate interglacial stages have resulted in the formation of these terraces.

The earliest implementiferous deposit, the Boulder conglomerate is dated to the second glaciation. The earliest man of the region was thus, living in cold conditions and was making massive flakes of Pre Soan tradition (De Terra & Paterson. 1939 : 294). The *in situ* position of the Boulder conglomerate is in the form of the terrace Td, on the Indus and the Soan rivers. The old gravel of the terrace 1 contained rolled implements of the Abbevilleo-Acheulian tradition, along with the artefacts of the Early Soan facies. This evidence suggests that there was,...... "a parallel development of this pebble industry, with early palaeolithic hand axes" (De Terra & Paterson. 1939 : 295). The Potwar gravel is also the horizon for the Early Soan, which is retained in the terrace 2 and also underlying deposits of the terrace 3. The deposition of this gravel is indicative of a cold and wet phase. The Potwar loess, which is the formation of hot dry conditions, overlies the gravel. Late Soan artefacts were obtained from the loess. Thus, it may be suggested that, "At the beginning of the loess period, the Soan people had developed a more specialized industry"...... (De Terra & Paterson. 1939 : 295). Coeval with the fourth glaciation is the aggradation of the terrace 4. From this terrace the investigators obtained late palaeolithic implements of the Evolved Soan facies.

SITES

Sites discovered by the Yale-Cambridge Expedition are as follows :

PRE SOAN SITES

Duliali (72° 48′ E & 33° 22′ N) : On the right bank of the river Soan near Chauntara, were found Pre Soan flakes (Paterson & Drummond. 1962 : 31-32). Though marked on the map the locality is not named in the earlier publication (De Terra & Paterson. 1939 : 302, Fig. 180).

Kallar (73° 26′ E & 33° 27′ N) : Mentioned in both of the reports, the locality has yielded only one massive flake, which was found in the Jhelum fan.

Gariala (72° 15′ E & 33° 45′ N) : Situated on the river Indus, it has revealed both Pre Soan and Stellenbosch artefacts in worn out condition.

Besides, Pre Soan implements were discovered from seven other localities, from where artefacts of the Soan tradition were also obtained.

SOAN SITES

Jalwal (72° 00′ E & 33° 35′ N) : Along with Pre Soan artefact in worn out condition, this site has revealed the Lower and the Middle Soan tools in fresh condition.

Makhad (71° 44′ E & 33° 07′ N) : Situated on the confluence of the Soan and the Indus, it has yielded Pre Soan, and also the Middle Soan tools.

Adiala (73° 00′ E & 33° 27′ N) : Comprising three localities the vicinity of Adiala, has brought to light artefacts of a number of facies of Soan *e.g.*, the Middle Soan B, the Upper Soan A, and also the Pre Soan.

Grand Trunk Road (73° 06′ E & 33° 33′ N) : Either side of the road retained ancient sediments, from which were obtained Pre Soan, the Middle Stellenbosch, the Upper Soan A and the Upper Clactonian A and B. The artefacts of the Late Pleistocene were found in fresh, while those of the Middle Pleistocene (Pre Soan and the Middle Soan) in worn out conditions.

Sihal (72° 48′ E & 33° 20′ N) : Situated on the right bank of the Soan this locality has revealed Pre Soan, as well as the Upper Soan artefacts. The latter is in fresh condition while the former is in worn out condition.

Ghila Kalan (72° 44′ E & 33° 15′ N) : It is situated on the river Soan, which has yielded the artefacts of the Late Pleistocene epoch. These are of the Upper Soan A and the Upper Clactonian traditions. However, Pre Soan in its usual worn out condition was also found from this site. In the earlier report, this locality is mentioned as a workshop of Late Soan facies (De Terra & Paterson. 1939 : 292).

Mangot (73° 15′ E & 33° 29′ N) : Referred to by de Chardin and de Terra as Malakpur, this vary site has revealed artefacts of Pre Soan and Upper Soan traditions.

Shadipur (71° 43′ E 33° 01′ N) : The vicinity of the village near the confluence of the Soan and the Indus has yielded artefacts of the Lower Soan and the Middle Soan traditions.

Khushalgarh (71° 52′ E & 33° 30′ N) : It is located in the valley of the Indus, around Kohat Railway bridge. Artefacts of the Lower Soan in rolled condition and the Middle Soan in fresh condition were found.

Injra (71° 52′ E & 33° 07′ N) : The confluence of the Soan and the Indus river near Injra, retained reminiscents of the Lower and the Middle Soan traditions.

Balawal (72° 43′ E & 33° 18′ N) : It lies on the right bank of the Sil river which meets the Soan in the vicinity of the village of the same name. From the basal gravel of the Potwar series, here, artefacts of the Upper Soan and the Middle Soan were obtained.

Sud (72° 55′ E & 33° 23′ N) : Parts of the terrace 2 and 3 were discovered, here. The Boulder conglomerate forms the base of the terrace 2, which has yielded the Upper Soan implements in fresh condition, while the Middle Soan artefacts were found in much worn condition.

Chaomukh (73° 44′ E & 33° 16′ N) : Located on the Poonch river, a series of second interglacial and Potwar loess deposits were found here. The Middle Soan implements were obtained from the second interglacial beds.

CULTURE SEQUENCE

In the earlier report, the Soan culture is shown developing through six stages, namely, A, B and C facies of the Early Soan; A and B facies of the Late Soan, and the Evolved Soan (De Terra & Paterson. 1939 : 304-310). The basic division of the Soan tradition within Early, Late and the Evolved Soan was done in accordance with their stratigraphic occurrences. But, further scrutiny of the former two within A, B and C facies is based primarily on account of the state of preservation and patination on the artefacts. Such a division of culture facies, may not be a reliable criterion for scientific analyses and interpretations. The investigators also noticed one non-Soanian trend. This is the Abbevilleo-Acheulian trait, which according to them had a parallel existence, independent of the Soan culture. Another small tool-kit *viz.*, the Pre Soan, which comprises massive flakes, may or may not form part of the Soan culture complex. The significance of this group is that its earliest occurrence preceeds the Soan horizons.

A modified version of the lithic sequence of the Potwar area is available in the later publication (Paterson & Drummond. 1962). In this, some of the new lithic traits are recognized and also new terms are used. Though the group of massive flakes remains unchanged, the Soan succession now has a different set of nomenclature. For instance, the six stages of this culture have the respective order of—the Lower Soan, the Middle Soan A and B, the Upper Soan A and B, and the Final Soan. Similarly, the Abbevilleo-Acheulian element is now referred to as the Middle Stellenbosch and the Upper Stellenbosch, and the tradition of flakes is named as the Upper Clactonian. The investigators also claim evidence for a continuous growth of the Soan trait, occassionally showing signs of contact with one or the other. For example, there is reference that, while having an uni-lenear growth Soan culture came into contact with Stellenbosch. The resultant assemblage is the Upper Soan Stellenbosch of the terrace 3. Similarly, Stellenbosch and Clactonian came into contact with each other at the time of the re-deposition of the Potwar loess, in the same terrace. But, the stream of the Soan culture growth remained uneffected by and large from the other co-existing culture traits, and culminated into Final Soan at the time of the fourth aggradation. These claims are unconvincing, as the entire hypothesis is based on insufficient data.

DETAILS OF THE CULTURE STAGES

Due to non-availability of the Potwar palaeolithic collections for personal examination, an evaluation of the typo-technological characteristics of the Soan tool-kits, as mentioned in the reports, is attempted here. Due to the fact that these publications put forth two different sets of sequences for the Soan group, individual facies of the each set is described one after the other. Without any modification, Pre Soan, however, is retained in the later publication also. But for the general convention that Pre Soan is unconnected with the Soan culture growth, the discussion of this stage may look out of place, as the main theme of this section is the exclusively chopper-chopping localities. Inclusion of Pre Soan in this part was necessary for the fact that it's relationship with the main stream of Soan culture development cannot be denied completely.

PRE SOAN

Pre Soan seems to be the earliest assemblage of the region. For, it comes from the top of the Boulder conglomerate of the terrace TD, which has been dated to the early part of the Middle Pleistocene or late part of the Lower Pleistocene (Paterson & Drummond. 1962 : 59). It is rather surprising that the investigators have described ten localities of this facies, and the total number of artefacts mentioned are only eight. They note that, "The pieces were widely scattered and only eight were found" (Paterson & Drummond. 1962 : 59). In any case, the total number of artefacts is very small for any significant interpretation, but, as the evidence stands, the ratio between the flakes and the pebble tools is 6 : 2. Both the artefacts made on pebbles are small 'unilateral nucleates' of Soan type 6. To us this form looks like a chopping tool or could be a core (Paterson & Drummond. 1962 : Fig. 18b). The main component of the assemblage, the flakes,... "are large with big plain striking platforms at high angles ranging from 100° to 125°" (Paterson & Drummond. 1962 : 59). They do not evidence marks of preparation and are also not retouched. Though no core was discovered, it is presumed by the investigators that simple asymmetric and pebble types may have accompanied this group. Though small, the group does suggest that advance forms of tools made on pebbles as well as flake detaching techniques were not in vogue in the present stage.

Genuineness of the Pre Soan is challenged by scholars, on the grounds, that the number of artefacts is insufficient and the nature of the tool-kit is not fully known (Misra. 1965 : 9-10). The artefactual character of the massive flakes was also questioned (Oakley. 1957 : 203). Besides, the existence of the Pre Soan as a separate culture trait is also debatable.

Occurrence of Soan type 6, along with the massive flakes may wipe out the doubt regarding the artefactual character of the Pre Soan group. Because, fashioning of this artefact class is beyond the capacity of natural agencies. Since the type is not referred to by the investigators in their earlier report (De Terra & Paterson. 1939), and the later was not available for quite some time, it could not be taken note of by the scholars. Incidentally, three out of eight specimens of the Pre Soan group are illustrated in the later publication (Paterson & Drummond. 1962 : Fig. 18). It may be mentioned that, evidence for a horizon similar to the Pre Soan, is being reported from some other parts of the country too. For instance, survey of southern Uttar Pradesh, by Pant, brought to light a horizon of massive artefacts, which preceeds the well established Acheulian levels (Pant. 1978). The preponderate position of big flakes, is followed by a limited number of Acheulian fossil types at these localities. It may be argued that, since the Indus system is the home for chopper/chopping, it is the Soan artefact type which accompanies the massive flakes in this region and not the

Acheulian since the occurrence of the latter is very limited. Seen in this light, the Pre Soan horizon may not look an isolated example, and needs to be given a serious thought. The objection, for a separate entity of the Pre Soan, is well defended by the investigators in their later publication. Paterson and Drummond, name this small group of tools Pre Soan, "On account of their rarity and consequent indefinite "industrial" connotation, ... indicating their chronological rather than cultural position" (Paterson & Drummond. 1962 : 59). Besides, they have also made their stand clear by stating that, "The name pre-Soan has been mistakenly assumed by some to imply that these tools are not related to the Soan culture, and it appears necessary to make clear that the chronological significance of the name given to the group does not rule out the possibility of its being related to the Soan. There are not enough specimens to justify a statement one way or another, and, it would be unwise to make one. We believe that it is probable the group does belong to the Soan and might be called Lower Soan A, but we prefer to leave the question open" (Paterson & Drummond. 1962 : 59-60).

EARLY SOAN

Making of chopper chopping, according to Paterson in his earlier account succeeded the massive flake tradition (De Terra & Paterson. 1939 : 307). The noteworthy techno-typological features and the state of preversation of the Early Soan group are as follow :

The artefacts of the Early Soan A, have deep patination of brown and purple colours, and they are also rolled. The assemblage is composed of types (i) and (ii) of Flat-based, and all the four earlier types of the Rounded pebble tools, and also, crude discoidal cores. No flake has been noticed in this group.

The Early Soan B, though retains thick patination, it is devoid of rolling. In this group, except for type (i) of the Rounded pebble, which is absent, all the earlier forms were noticed. The flakes associating the group resemble in their morphological character with the early Clactonian type from Europe (De Terra & Paterson. 1939 : 307).

The amount of patination further decreases in the Early Soan C, and the artefacts are also in fresh condition. Though all the types occur, the most prevalent form is the Rounded pebble type (ii). Besides, a new form emerges in this stage. This is the type (v) of the Rounded pebble, which became more frequent in the following stage, the Late Soan.

The distribution of the typological categories of the chopper-chopping in the three stages of the Early Soan facies, as per the present author's assessment does not bring out sharp typological distinctions, which is apparent from the following comparative chart.

Chopper- Chopping types	Early Soan A	Early Soan B	Early Soan C	Paterson's types
Lateral chopper	Present	Present	Present*	Type *a* (i) Type *b* (ii)
Chopper with narrow edge	Present	Present	Present	Type *a* (ii) Type *b* (ii)
Pointed chopper	Present	Present	Present	Type *b* (iv)
Lateral chopping-denticulate	Present	Present	Present	Type *b* (iii)
Chopping with narrow edge	Present	Absent	Present	Type *b* (i)
Lateral chopping with straight/ convex edge	Absent	Absent	New Arrival	Type *b* (v)

It is, however, difficult to make out further morphological details of the chopper-chopping from the account, as the main emphasis of the investigators is on the form of the raw material utilized for this class, rather than the typological characters. The conversion of the investigators' data (De Terra & Paterson. 1939), into the above typological chart, clearly suggests that the three stages of Early Soan claimed by Paterson lack conviction. For, the absence of chopping tool with narrow edge, Rounded pebble type (i), in stage B and the occurrence of Lateral chopping tool with straight/convex edge, Rounded pebble type (v), are not very distinct forms. Their absence or emergence could be a mere chance. It would have been fruitful to argue the situation after the quantitative data, which has not been referred to by Paterson.

LATE SOAN

Chopper-chopping of the third glaciation is named Late Soan by Paterson (De Terra & Paterson. 1939 : 308-310). Though implements made on pebbles continue as the basic culture component, there is an inclination towards producing flake tools also. This facies is divisible into two stages.

* The quantitative Value attached to the words are as follows :
Present—denotes were appearance of the type
M. Fre.—indicates that the type is most frequent in the collection.
V. Fre.—suggests occurrence of the type in good proportion.
New Arrival—indicates the first appearance of the type.

On grouuds of it's association with the Potwar gravel, which precedes the Potwar silt, Late Soan A is earlier than the stage B. In Late Soan A, though simple forms of the flakes were still prominent, Levallois appears as a distinctive character. Tools made on pebbles are dominated by type (v) of the Rounded pebble. Besides, type (i) of the Rounded pebbles and type (iii) of the Flat-based also fair well. A new form appears, which is in fact a modified variety of the Flat-based type (iv). In this case, an avoidal shaped pebble of a range 1 3/4 × 1½ to 3½ ×2 was obliquely split. Thereafter,... "two or more flakes, are then struck upwards from the under surface on the side that makes an acute angle with the base" (De Terra & Paterson. 1939 : 308).

The Late Soan B was obtained from the Potwar silt. The artefacts are quite fresh. The flake element in this, completely overpowers the Soan tool-kit. The flake group is said to have greater resemblance with the "Late Levalloisian Europe".

The forms of the Soan tool types in the B stage of Late Soan are not described. Thus, it is not possible to ascertain their micro morphological categories. Since the emphasis is on the technological classes of flakes and cores for detaching flakes, marked change in the typology of the tools made on pebbles is not apparent from the account of the investigators. However, the typology of the late Soan B is as follows :

Chopper-Chopping types	Late Soan	Paterson's types
Chopper with narrow edge	Frequent	Type *b* (ii)
Lateral chopper	Frequent	
Peripheral chopper	New Arrival	Type *a* (iii)
Chopping tool with narrow edge	Frequent	Type *b* (i)
Lateral chopping denticulate with edge	Present	Type *b* (iii)
Lateral chopping with straight/ convex edge	Frequent	Type *b* (v)
chopping/core on split pebble	New Arrival	Modified form of Type *a* (iv)

Introduction of a definite type, the peripheral chopper, Flat-based type (iii), is the only noteworthy feature of Late Soan tool-kit. The development of chopper-chopping in the latter, seems to be aimed at attaining smaller and neater forms. Technological refinement is also apparent from the flakes and cores of the groups. A definite change from the crude Clactonian way of the Early Soan is seen developing into the evolved Levallois stage.

In comparison to the earlier publication more details of the typological counts of the Potwar tool-kits are available in the later report (Paterson & Drummond. 1962). A critical account of the various stages of Soan facies, after Paterson and Drummond is described hereunder.

THE LOWER SOAN

The earliest chopper-chopping tool assemblage, the Lower Soan, is reported from four localities, *e.g.*, Shadipur, Jalwal, Khushalgarh and Injra. The group is represented by forty-eight artefacts which are marked by deep brown or purple patina. Since they were obtained from the high surface of the Boulder conglomerate or the eroded slopes, they are dated to the early phase of the Middle Pleistocene (Paterson & Drummond. 1962 : 60).

The tool-kit is marked by heaviness, though there are a few smaller implements. The proportions between the cores, flakes and tools of Soan group are approximately, 1 : 2 : 3. Flakes in general are crudely made, and most of them have thick body and high angled platform. Though on few specimens partial preparation of the dorsal surface is viewed, their striking platform remains unprepared in all the cases. There is just one flake showing use of bi-polar technique. Retouching appears for the first time, but, it is restricted to only a few flakes. Though the flakes of this stage are better made, in comparison to the Pre Soan, their number is smaller than the other. The six cores belong to proto-bifacial, asymmetric, pebble, spindle and simple tortoise types (Paterson & Drummond. 1962 : 62).

The tools made on pebbles, which form roughly fifty percent of the total assemblage is preponderated by two types *i.e.*, Soan type 4, the convex edged oblates and, Soan type 6, the unilateral nucleates. The other forms occurring are, Soan types 1, 3 and 5. The investigators observe that, "The flat-based tools are few in number in comparison with the oblate pebble forms. This contrast is a natural feature of an early stage in development for the direct use of an oblate pebble itself is probably a simpler technique than the spliting a pebble prior to flaking it" (Paterson & Drummond. 1962 : 60).

THE MIDDLE SOAN

The Soan trait of the Middle Pleistocene further grew in the form of the two stages of the Middle Soan. The earlier stage A, is though later than the Lower Soan, it is earlier than the B stage. Due to their association with the highest depositional terrace surface of the Boulder conglomerate and also from the slopes, they are dated to the second phase of the Middle Pleistocene (Paterson & Drummond. 1962 : 63).

The Middle Soan facies is reported from nine sites *viz.*, Shadipur, Jalwal, Khushalgarh, Makhad, Injra, Adiala, Balawal, Sud and Chaomukh.

The stage of Middle Soan A, is represented by the fifty-one artefacts. These are unworned, and have brown and purplish brown patinated artefacts. Soan types are subdued in count, while flakes and cores for detaching flakes fair well (ratio between the tools and flake-core being 1 : 4). The artefacts are still large and heavy.

The cores of the assemblage are of pebble, spindle and proto-tortoise types. Use of pebble core decreases during this stage, as only one specimen of the type was found. Some of the specimens of the flake group resemble the types found in the "early Levallois culture of Europe" (Paterson & Drummond. 1962 : 66), which indicate, that advanced flake detaching technique was skilled in this stage. Retouching is still of coarse variety and is occassionally seen in the form of rough step flaking.

In the group of eleven tools, Soan type 6, the unilateral nucleate dominates over the others. Types 7 and 8 are conspecious by their absence, while the boat shaped implement, Type 3, appears. In comparison to the Lower Soan, the Flat-based implements become more common, but the oblate pebble forms do not show a development.

The Middle Soan B, is dated to the later part of the Middle Pleistocene or the early phase of the Late Pleistocene, since the remains of this were acquired from the re-deposited gravels of the terrace 1 and 2 (Paterson & Drummond. 1962 : 66). The wear and tear of the artefacts of this stage is in great contrast to the earlier. For, they are unworn and also a little patinated. In all eighty-four artefacts were discovered, which are preponderated by the Soan type of tools. The ratio between the three types *i.e.*, the Soan types, the flakes and the cores comes to 37:17:13. Flakes and cores, now distinctively mark the practice of a comparatively advanced technique. For instance, in cores the most common type becomes the proto-tortoise cores, which are nine out of the total of thirteen specimens. The pebble, asymmetric biconical, proto-biconical and spindle types are one each (Paterson & Drummond. 1962 : 69). The flakes in general seem to correspond with the forms of the cores. Retouching though present, is still not of sophisticated variety.

Chopper-chopping group is dominated by Soan type 4, the convex oblate, which are eleven out of the total number of thirty-seven. This is followed by Type 6, the unilateral nucleate (10 : 37). Whereas, Soan types 1,3,5,7 and 8 appear in nominal proportion, either one or two, each. But Soan type 2, the unilateral flat-based, similar to lateral chopper on split base of our classification is also prevalent in the tool-kit.

The above discussion brings out the following features of the Soan trait of the Middle Pleistocene epoch. The trait was in very limited proportion 1:3 (Soan : flake) in the Pre Soan and also 1:4 in the Middle Soan A. But, the proportion of the pebble tools almost equals with the flake-core element in the succeeding phase (1:1 in the Lower Soan, and 1:1.2 in the Middle Soan B). It is, however, difficult to ascertain the proportion of by-products and intentionally detached flakes, on the basis of the publication under study.

Chopper-chopping types	Lower Soan	Middle Soan		Soan types
		A	B	
Chopper with narrow edge	Present	Present	Present	Flate-base 1.
Lateral chopper	Absent	Present	V. Fre.	,, 2.
Scraper on split pebble	Present	Present	Present	,, 3.
Chopper with straight/convex edge	M. Fre		M. Fre	Oblate 4.
Chopper pointed	Present	Present	Present	,, 5.
Lateral chopping/core	V. Fre.	M. Fre.	V. Fre.	Nucleate 6.
Chopping peripheral	Absent	Absent	N. Arr.	,, 7.
Uniface-oval	Absent	Absent	N. Arr.	,, 8.
TOTAL NUMBER OF TOOLS	24	11	37	

It is apparent from the above chart that within the group of Soan tools, Type 6 is fairly well represented in all the stages. In the Soan, it is cent percent of the tools. The type continues to enjoy majority in the Lower and the Middle Soan A facies. In the Middle Soan B, however, it is subordinated by the Type 4 (30% of the pebble tools). But, even then it has good proportion *i.e.*, 27%. Type 4 also has a satisfactory position in the Lower and the Middle Soan A. Other forms seen in the Middle Soan B, also appear in the Lower and the Middle Soan A. However, two types, Chopping peripheral and Uniface oval are introduced, for the first time, in the Middle Soan B.

Lateral chopping tool seems to have been a favourite form of the Soan tool-kit of the Middle Pleistocene. As was noticed in the earlier account (De Terra & Paterson.

1939), denticulated edge may be a common type in the lateral chopping tool, which is usually made on round pebbles. Choppers are variedly described, wherein straight and convex edges are very common. Pointed chopper is crude in the early facies, but is well made later. Chopper made on split pebbles, when natural flat-base does not fully satisfy the requirement, is the type more in vogue in the later assemblages.

Flake detaching technique shows gradual development from Clactonian to the earlier facies of Levallois, but didnot attain the perfection of the classical Levallois during the Middle Pleistocene period.

THE UPPER SOAN

This assemblage has been associated with the gravel of the third glaciation, and the Potwar loess of the Upper Pleistocene (Paterson & Drummond. 1962 : 71). One of the largest collection of the Soan basin, it was obtained primarily from Ghila Khan. The ratio between the flake, core and the Soan type in this tool-kit is 1:1:1. Flakes and cores do not show very advance forms. As faceted striking platform is not present in its classical form. However, there are biconical cores, tortoise cores and unfaceted cores. In the group of tools made on pebbles, Soan type 5 and 8 are absent. Though all the other forms are seen, the most common occurrence is that of the peripheral nucleate, Soan type 7 (Paterson & Drummond. 1962: 71-76).

Stage B of the Upper Soan, is contemporary with the basal gravel of the terrace 3. The largest collection is reported from Adiala, from where 600 artefacts were picked up. Core types in this are more advanced than the Upper Soan A. Fifty-eight flakes out of the total of 233, are unprepared and the remainings are of unfaceted and faceted types. The possibility of some of the specimens of the unprepared flakes, belonging to the category of by-products, can not be ruled out. In the group of tools, Soan types 2, 3, 4, and 5 are unrepresented. Types 6 and 5 are though present they are of rough forms. Terminal flat-base Type 1, is the most frequent type. Besides, the other characteristic form is the classical type of the turtle back, which appears in this stage for the first time (Paterson & Drummond. 1962 : 76-83).

In the Upper Soan, the forms common with the earlier facies become less frequent. The tendency is noticable in the absence of the forms like lateral chopper, scraper on split pebble, chopper with convex/straight edges and pointed chopper, which occur in the Middle Soan A and B. Thus, there was perhaps preference for certain forms in the Middle and the Upper Pleistocene times.

Chopper-chopping types	Upper Soan A	Upper Soan B	Soan types	
Chopper with narrow edge	Present	M.Fre.	Flat-base	1
Lateral chopper	Present	Absent	,,	2
Scraper on split pebble	Present	Absent	,,	3
Chopper with straight/covex edge	Present	Absent	Oblate	4
Chopper pointed	Absent	Absent	,,	5
Lateral chopping	Present	Present	Nucleate	6
Chopping peripheral/Core	M. Fre.	Present	,,	7
Uniface oval	Absent	Frequent	,,	8

THE EVOLVED OR FINAL SOAN

The assemblage dated to the fourth glaciation, is referred to by Paterson in his earlier publication as the Evolved Soan (De Terra & Paterson. 1939 : 310-11). The same group is named afterwards the Final Soan (Paterson & Drummond. 1962 : 84-88). The industry is reported from the Pindi Gheb, and consists of 343 artefacts. One hundred and seventy of them are the Soan type of implements, which are of following categories.

Chopper-chopping types	Position	Soan type	
Chopper with narrow edge	Present	Flat-base	1
Lateral chopper	Present	,, ,	2
Scraper on split pebble	M.Fre.	,,	3
Chopper with straight/convex edge	Absent	Oblate	4
Chopper pointed	Present	,,	5
Lateral chopping	Present	Nucleate	6
Chopping peripheral core	Absent	,;	7
Uniface-oval	Present	,,	8

Types 4 and 7 are absent, but all the other forms are present. Most common type is the bilateral flat-base, Soan type 3 (Paterson & Drummond. 1962 : 84-88). The cores are of asymmetic pebble and disc forms, while, the smaller flakes of the industry are perhaps the by-products of the disc cores.

During the seventies Krantz discovered a group of two hundred and ten artefacts from the Boulder conglomerate of the terrace 2, near Ghila Kalan (Krantz. 1972 : 66-82). A broad grouping of the collection is available, which describes these to be chopper-chopping (34), discoidal flakes (105), Levallois like flakes (54), blade (16) and undetermined specimens (21). However, the advancement attained by this group of artefacts does not tally with the other group. For, the artefacts obtained by the earlier investigators from Bould conglomerate of the terrace 2, are typo-technologically much behind the Ghila Kalan industry.

The above account reveals that a clear continuous development of the chopper-chopping trait, was spread out from the Middle to the Upper Pleistocence times, in the Potwar region. A noteworthy feature of the development of chopper-chopping during the Upper Pleistocene times was the marked preference for smaller and neater shapes of the Soan types. There also exists difference between the choice of the raw material between the Middle and the Upper Pleistoecne tool-kits. For instance, in the later phase of the Middle Pleistocene there seems to be a definite preference for utilising split pebbles for converting the chopper-chopping but in the later period, the practice was abandoned in most of the cases. Greater quantities of flakes in the Upper Pleistocene facies, perhaps took care of the requirement of the split based implements.

II

THE NORTHERN INDIA

The foot hills of the Himalayas, in the East Punjab, Himachal Pradesh, Jammu and Kashmir provinces, have retained evidence for the exclusively chopper-chopping localities but these are comparatively fewer in number as compared to the Potwar region.

The foot hill of the Siwalik range and its vicinity are of particular importance for the Pleistocene remains. The plains of the East Punjab, to the west, and, the mountain region of the north-east is separated by the Siwalik hills, which are composed of Pliocene and Pleistocene formations. On the Indian side, where chopper-chopping sites are located, the area is traversed by a number of rivers *e.g.*, the Ravi, the Beas, the Sutlej and the Ghaggar systems. Thus, the drainage pattern of this area has a general similarity with that of the Potwar region. Pleistocene remains of the sediments and cultures are reported from the Ravi, the Beas, the Sutlej and the Ghaggar.

HISTORY OF RESEARCHES

The history of palaeolithic finds of the region commences with the chance discovery of stone artefacts at Cemetry H site, by Old H. Prufer. In the year 1961, while looking for the evidence of the Indus Valley Civilization in Satlej valley, Prufer found palaeoliths also (Ref. Mohapatra. 1974 : 200). In the subsequent years, Krishnaswami, Sharma, Sen, Lal, Joshi, Mohapatra, Khazanchi and Pant explored various river valleys, in search of palaeoliths and the palaeo-climatic evidence. As a result of these surveys, the river systems like Sirsa-Sutlej, the Beas-Banganga, the Ravi, the Basantar and the Ghaggar, were marked as the chopper-chopping yielding areas, on the map of the palaeolithic India.

Initiated by Y.D. Sharma and Krishnaswami, the followup investigations in the Sirsa-Sutlej valley, by Sen and Mohapatra has brought to light a number of chopper-chopping locales. The later investigators have also discussed the evidence for palaeoclimate in this area, which has been incorporated in the succeeding section. Sharma discovered five Late Soan group of sites in the Sirsa valley (*IAR 1954-55* : 58), while Krishnaswami noticed three terraces on the Sutlej. Associated with the lower two terraces were found artefacts of the Early Soan tradition (*IAR 1962-63* : 37-38). The potentialities of Beas-Banganga valley was brought to light by painstaking surveys by Lal and Mohapatra. Joshi's investigations, in between the former two, however, was to evaluate the claims made by Lal. The finds of these surveys are discussed a little later, as they deserve elaboration.

Since the survey of the Ravi, the Basantar and the Ghaggar, were of primary nature, the discoveries made from these areas are of sphoradic type. Two sites are reported from the Ghaggar valley, which have yielded pebble choppers and unworked pebbles (Mohapatra. 1966). The team lead by Khazanchi, noticed four terraces on the river Ravi, around Lakhanpur, in Kathua district (*IAR 1965-66* : 19). Five other sites were also noticed during this survey. The implements obtained from these belong to the Pre Soan and the Early Soan traditions. The Pre Soan group is represented by massive flakes, while the Early Soan consists of chopper of various types, and flakes of Ciactonian proto-Levallois types. Fashioned out of quartzite pebbles, choppers have rounded, pointed or straight butts and convex, straight or irregular edges. Terrace 3, here revealed smaller sized pebble tools.

Pant and Singh report the discovery of terraces and artefacts on the banks of the river Basantar, in Kathua district (*IAR 1968-69* : 9). No typo-technological detail of the tool-kit is available. But in all probability the group of about fifty artefacts seems to represent the Soan tradition.

Early Soan group of implements was reported by Mohapatra and Saroj, from Jammu and Kathua districts (Mohapatra & Saroj. 1969 : 11-12). The tools from these had typological similarities with the Early Soan group of Potwar. A pointed chopper, which was also noticed by Lal in the Beas-Banganga region, and is also referred to by Paterson and Drummond as pointed oblate nucleate type, is highlighted by the investigators, who state that... "unifacial pebble tool is exceptionally interesting", as, "Its pick like from is a distinct departure from the chopper-chopping tool typology" (Mohapatra & Saroj. 1968 : 11). The significance of this specimen is described as,... "this provides a clue which when carefully followed might help us in settling the long drawn controversy about the presence of handaxe-cleaver culture in this part and its relationship with the Sohanian" (Mohapatra & Saroj. 1968-69 : 11).

PALAEO-CLIMATE

Similar to the Potwar region, the climatic change of the Pleistocene epoch, in the area under study, are marked by terrace formations. There is not a uniformity in the counts of the terraces, as two to seven are reported from the various river valleys of the region. For example, four terraces were noticed on the river Ravi, in Kathua district, by Khazanchi (*IAR 1965-66* : 19). But, only two terraces could be formed by the river Ghaggar near Dera Kharauni and Chandi-Mandir (Mohapatra. 1974 : 209).

The banks of the river Sirsa around Nalgarh, retained three terraces, which are 70′, 40′ and 10′ high. These are dated to the Lower, the Middle and the Upper Pleistocene periods, respectively (Sen. 1955 : 178-79). Soan group of tools were obtained from the upper two terraces. The river Sutlej also had three terraces, which were noticed at Alsu, Dahar and Bilaspur, by Krishnaswami (*IAR 1962-63* : 37-38). The upper terrace in this case was devoid of artefacts, while the Early Soan group of implements were obtained from the lower two terraces. On the basis of these accounts, it may perhaps be suggested that the Sirsa-Sutlej valley, in all had four terraces. The earliest terrace of the Sutlej is unrepresented in the Sirsa while the latest of the Sirsa is absent in the former valley.

The terrace succession of the Beas-Banganga seems to have five to seven stages. The basic geological composition of the late Siwalik series, as else where, here too is formed by the erosional and accumulative activities of the Middle and the Late Pleistocene times. Near Guler, on the banks of the Banganga, Lal noticed reminiscents of five terraces. It is interesting to note that in the same region, Mohapatra noticed seven terraces. A joint expedition of Geological Survey of India, Deccan College, Pune and the M.S. University, Baroda, seems to agree with the observations made by Lal (Sankalia. 1962 : 20). Lal picked up six palaeoliths from the terrace 1, which is 565′ high. The eighteen artefacts associated with next terrace (375′), were obtained from the banks of *nalas* and slopes of the terrace 2. The last implementiferous terrace is 3, which has yielded only ten artefacts. This terrace is 278′ high. Terraces 4 (165′) and 5(30′) are devoid of human activities (Lal. 1956 : 64-68). The height of the seven terraces as mentioned by Mohapatra are —terrace 1, 578′ : terrace 2, 395′ ; terrace 3,278′; terrace 4, 165′ ; terrace 5, 158′ ; terrace 6, 98′ and terrace 7, 28′ (Mohapatra. 1966). Pebble tools were obtained from the first four terraces. From the terrace 4, along with tools made on pebbles, a flake industry, and few implements of polished stone tradition were obtained.

Joshi's examination of the Kangra valley with Rozycki and Chmikwski, suggests that the terraces on the Beas and Banganga are ... "not formed by glacial action, but by the formation and erosion of cones in foot hills" (Sankalia. 1974 : 31). The artefacts found scattered on the terraces, would thus, belong to a later date than the formation of these terraces.

SITES

The sites located in Jammu and Kashmir are as follows.

Lakhanpur *Kurro* (75° 55′ E 32° 38′ N) *Pinyani* *Tarra* (70° 35′ E & 32° 25′N) *Mah* *Jagatpur* *Jandore*	All of these are reported from the valley of the Ravi river (*IAR 1965-66* : 19) in Kathua district (Mohapatra & Saroj. 1968-69 : 11-12).
Nandi *Manua* *Paltha*	Evidence for terrace and palaeoliths were found on the banks of the river Basantar (*IAR 1968-69* : 9).
Kuta (75° 15′ E & 32° 30′ N) *Dyalachak*	Early Soan tools were discovered from the Ben valley in Kathua district.
Nagrota (74° 55′E & 32° 50′N)	The banks of the in Tawai Jammu district has yielded Early Soan tools (Mohapatra & Saroj. 1968-69 : 11-12).
Drui	The Basantar valley in Jammu district has revealed Early Soan tools (Mohapatra & Saroj. 1968-69 : 11-12).

The sites of the Sirsa -Sutlej valley lie within the political boundaries of Ambala and Kangra districts.

Basawal *Baddi* *Bhud* (75° 49′E & 32° 05′N) *Beli Diwwar* (76° 44′E & 32° 01′N). *Khora-Kachoa* *Malpur* *Nalgarh* (76° 44′E & 31° 43′N) *Pirthan* *Palasi* (76° 40′E & 31° 02′N)	Located in Ambala district, the banks of the river Sirsa at these sites have yielded artefacts of the Early Soan group (Sen. 1955; Mohapatra. 1966).
Rampur (76° 03′E & 30° 49′N) *Haripur* (76° 10′E & 32° 0′N)	The river Sirsa, Ambala district, at these have yielded Early Soan tools from terrace 1 (Mohapatra. 1974).
Dher Majra *Dhang* *Dadhi* (76° 35′E & 31° 10′N) *Marhanwala*	Located in the above mention area, these localities have revealed artefacts of Late Soan group (*IAR 1954-55* : 58 ; Sen. 1955).
Alsu *Dahar* (76° 51′E & 31° 24′N) *Bilaspur* (76° 45′E & 31° 20′N)	Three terraces were noticed on the banks of the river Sutlej, in Kangra district. The artefacts belong to the chopper-chopping facies (*IAR 1962-63* : 37-38).
Daulatpur (32° 03′N & 76° 15′E)	Late Soan tools were obtained from Sohan, a tributary of the Beas (*IAR 1954-55* : 58) in Kangra District.
Kangara (32° 6′N & 76° 16′E)	The confluence of Banganga and Patalganga near the town, has brought to light remains of the Pleistocene times (Lal. 1956).

Guler (32° 1′N & 72° 9′E)	Situated on the right bank of the river bank of the Banganga, it has revealed the largest group of Lal's collection (Lal. 1956).
Dehra 31° 53′N & 76° 14′E)	Lying at a distance of 24 miles from Kangara, it is situated on the river Beas (Lal. 1956).
Dhabiara	This is four miles from Dehra towards Hoshiarpur.
Tira Sujanpur (76° 30′E & 31° 53′N) *Alampur* (76° 30′E & 31° 51′N) *Nadaun* *Dehra Gopipur* 76° 14′E & 31° 53′N). *Sunnet* *Phera* *Chambba—Ghat* (76° 45′ E & 31° 53′N) *Nandpur* (76° 25′E & 32° 5′N) *Bari* (76° 15′E & 32° 51′N). *Maleta* *Sirha* *Sonot Khas*	The Beas lying within the boundaries of the Kangra district houses these. Soan group of tools were obtained from various terraces (Mohapatra. 1966)
Haripur Bazar (76° 40′E & 32° 0′N). *Dibber*	Situated in the same district the Banganga bank at these are implementiferous (Mohapatra. 1966).
Ror	Also situated in the same area, Terrace 4 has yielded Early Soan, flake tools and Neolithic tools (Mohapatra. 1966).

The remaining sites of Ambala district are located on the banks of the river Beas and the Ghaggar, three and two in the respective order (Mohapatra. 1966).

Talwara *Dadasiba* *Baroli*	A limited number of Soan tools were discovered here.

Dhera Kharauni (76° 50′E & 30° 45′N) *Mansa-Devi / Chnadi-Mandir*	Pebble choppers and unworked flakes are reported from these.

CULTURAL REMAINS

The finds from the Sirsa and the Beas-Banganga valleys are elaborated here, which are comparatively well documented.

Sen claims that the artefacts obtained from both the upper terraces of the river Sirsa, are typologically similar to each other (Sen. 1955 : 180). This assemblage is devoid of Acheulian trait and is prevailed by the Early Soan characteristics. The single example, named proto-handaxe by Sen, is in fact morphologically similar to the Soan type 8, the turtle back of the Potwar region (Paterson & Drummond. 1962 : 58). The group of the chopper-chopping, referred to as chopper/scraper by Sen dominate the tool-kit. The flake detaching technique is not upto the mark. As simple cores on flattish, round or discoidal pebbles, showing unworked undersurface are the frequent forms. Similar to these most of the flakes are also characterized by undressed dorsal face and also unprepared or unfaceted, high angled striking platforms (Sen. 1955 : 181). However, proto-Levallois flakes with faceted platforms also occur, but, these are very limited in number. Classical Levallois is entirely unrepresented. A few specimens from the flakes have been converted into crude scrapers, points, knives and borers. Sen feels that, "The typological similarity in Nalgarh and the Early Soan industries of West Punjab indicates that the former is the extension of the latter in East Punjab" (Sen. 1955 : 181-83). It may be worthwhile to recall that the poor representation of the tradition of retouching in case of the Early Soan or the Lower Soan, is an apparent typological divergence, from the Sirsa industry, wherein the practice of retouching the artefacts is prevalent. It is difficult to ascertain in the present state of our knowledge, whether this difference was acquired in the normal course of the spatial spreads from the Potwar region to the Sirsa valley. Alternatively, it could be a case of culture variation.

Mohapatra claims to have obtained some new types in Sirsa valley, during the subsequent survey. On the basis of these finds, he feels that Sirsa industry presents many advanced features in technique and typology of tools (Mohapatra. 1974 : 208). In contrast to Sen who has equated his collection with the Early Soan of the Potwar region, Mohapatra compares his finds with the Beas-Banganga valley.

Mohapatra classifies the Sirsa industry within—flakes, scrapers, borers, bifacial discoids (recalling Mousterian technique), along with a fair proportion of chopper-chopping tools. Flakes in this case becomes smaller, and are present in good proportion. Retouching has begun in this case. But, "Inspite of all these advanced features, the Sirsa valley industry is still essentially an industry of pebble-tool tradition" (Mohapatra. 1974 : 209). We are unable to evaluate the typo-technological features of the Sirsa industry, since the material was not available for first hand study.

The Beas-Banganga industry comprises implements from various localities. It is interesting to note that the implements obtained by Lal from different terraces are similar to each other. The typological and the technological features of the Beas-Banganga group is well represented by the Guler assemblage, which is the largest collection of the area. The fifty-two specimens of the Guler tool-kit, which is made on quartzite pebbles comprises the following types (Lal. 1956) :

Types	Nos.	%
Chopper	24	46.15
Chopping tools	3	5.76
Proto-handaxe	4	7.69
Cores	5	9.61
Flakes	16	30.76
TOTAL	52	99.97

Two types are noticed in the group of cores. These are the discoidal and the non-discoidal. Flakes were obtained by Clactonian technique (12) and proto-Levallois technique (4).

Sankalia who re-examined this collection with Subbarao, is of the opinion that the percentage of the genuine tools in the Beas-Banganga collection is very low (Sankalia. 1962 : 20). Joshi thinks that the factor responsible for chipping off most of the specimens is not human hands, but, the natural agencies, such as, tactonic activities. The present author, who had an opportunity to examine the collection is inclined to agree with Lal's claim that most of the specimens are artefacts. Our observations on the Guler assemblage is discussed a little later.

The collection made by Joshi comprises of thirty three artefacts, which are of chopper and chopping tool categories (proportion of chopper : chopping=26 : 7). But, with this group were also found smaller artefacts such as points, flakes and cores. However, handaxes and cleavers were obtained from Nadral and Kotla and Dhavala-thana and Painsara, in the same area (Sankalia. 1974 : 33). Even this area seems to retain Stellenbosch like evidence, which was noticed in the Potwar region.

The subsequent work of Mohapatra in the Beas-Banganga region, has brought to light fourteen new implementiferous locales of Soan tradition. The dominant type in this collection also is the chopper, both of unifacial and bifacial types. "These are accompanied by a suitable proportion of flakes of small and big size" (Mohapatra. 1974 : 207). However, the exact proportion of these is not available. Flakes are said to be devoid of secondary working. "A very small number of flakes show flake scars on the dorsal surface, resembling the prepared flakes,..." (Mohapatra. 1974 : 207). There is a possibility that a part of these are by-products of chopper-chopping or primary dressing flakes of the cores.

While comparing the earlier cultural remains from the region Mohapatra states, "If both the Beas-Banganga and the Sirsa valley industries are considered as two facies of one culture (*i.e.*, Early Soan or the pebble-tool culture of the Indian Early Stone Age), the former is undoubtedly earlier in age and the latter its developed manifestation" (Mohapatra. 1974 : 209).

DETAILS OF THE SELECT ASSEMBLAGES

The reason for selecting the Bilaspur and the Guler assemblages is that, in the available collections, which were studied by the present author,* only these two had sufficient number to enabling the proposed scrutiny meaningful. Thus, the two are taken to represent the exclusively chopper-chopping assemblages of the north and the north-west India.

BILASPUR ASSEMBLAGE

Reported by Krishnaswami (*IAR 1962-63* : 37-38), the tool-kit was obtained from the terrace 2 and 3 of the river Sutlej, near Bilaspur, in Ambala district. The brief reporting though makes it clear, that, the collection belongs to the exclusively chopper-chopping tradition, it fails to mention further details.

Bilaspur assemblage is characterized by varied forms of implements made on pebbles both of flat-based and rounded forms. But, there seems to be preference for smaller pebbles which have flat dorsal and ventral surfaces with rounded sides. In most of the cases such pebbles are worked at one side by taking off small shallow careful chipping scars. There are however, a few massive choppers, which show typical bold working of the chopper-chopping tradition. For the fact, that, flat pebbles were available in abundance in this part of the Sutlej valley, Bilaspurians need not have to split these to acquire flat surface, a practice much in vogue in the Potwar region during the Middle Pleistocene times. This tendency is evidenced by the selection of the flat pebbles and scaricity of the split pebbles in the Bilaspur collection.

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* These are housed in the Safdarjung store of the Archaeological Survey of India, New Delhi, and could be studied by thekind Courtsey of the Director General of Archaeology in India.

THE MAJOR ARTEFACT-CLASSES

Artefact-class	Nos.	%
1. Chopper	50	50.50
2. Chopping tool	13	13.13
3. Scraper	2	2.02
4. Chopper/core	5	5.05
5. Chopping/core	5	5.05
6. Flake	2	2.02
7. Core	4	4.04
8. Diverse	18	18.18
TOTAL	99	99.99

In the above table finished implements are represented by the first three classes, and perhaps a few specimens of the fourth and the fifth groups. Noteworthy features of the eight categories are elaborated below.

1. *Choppers*

THE NATURE OF PEBBLES UTILIZED FOR MAKING THIS CLASS

Form of pebble (in plan)	Form of butt			Size-index (in mm)	Thickness: length ratio
	Round	Pointed	Straight		
Flat-based, broad	8	—	13	68-135	1 : 1.7-2.6
Flat-based, long	5	5	—	120-155	1 : 2.1-3.4
Flat-based, round	2	2	—	87-155.5	1 : 1.2-2.9
Rounded, broad	3	—	3	105-122.5	1 : 1.4-1.7
Rounded, long	2	5	—	67- 97.5	1 : 1.5-2.0
Rounded, round	1	1	—	43- 70	1 : 1.3-1.8
TOTAL	21	13	16	48.0-155.0	1 : 1.2-3.4

Greater number of choppers are made on flat-based pebbles. The longer axis of such pebbles is utilized for producing the working edge. The opposite end, the butt, in these is either straight or round, and never pointed. In those flat-based specimens, which have working edge at the shorter axis, form of butt is either round or pointed. Pebbles having equal measurement for both the axes can be seen in both, the flat-based and the rounded forms. Each of the group have approximately half of the specimens with rounded butt, while the remaining fifty percent have pointed butts. All the straight butted specimens belong to the lateral chopper category.

THE NATURE OF WORKING EDGE AND THE DISTRIBUTION OF THE TYPE OF WORKING ON THE CHOPPERS

Form of working edge	Nature of working				Total
	Bold	Shallow	Medium	Fine	
LATERAL CHOPPER					
Convex edged	1	1	1	3	6
Concave edged	1	1	—	—	2
Straight edged	2	2	—	4	8
Denticulate	1	—	—	—	1
NARROW EDGED CHOPPER					
Convex edged	3	—	—	—	3
Concave edged	1	—	—	—	1
Straight edged	1	5	—	1	7
Notched edged	—	—	—	1	7
Denticulated	3	—	—	—	3
SINGLE STROKED CHOPPER	2	—	—	—	2
POINTED CHOPPER	3	—	2	1	6
ROUND CHOPPER					
Convex edged	1	—	1	—	2
Straight edged	1	1	—	2	4
Denticulated	1	—	—	—	4
TOTAL	24	10	4	12	50

In choppers most of the specimens have straight edges. This form could be acquired with the help of fine carefull working or by detaching big but shallow scars. Similar form of edge was produced by bold working in some of the specimens (19 out of the total of 40). Convex edged choppers are also quite frequent, which show the working of all the four types. The less fequent forms are the denticulated choppers and the pointed choppers, while the convex edged specimens are also limited in number.

2. *Chopping Tool*

THE NATURE OF PEBBLES UTILIZED FOR MAKING CHOPPING TOOLS

Form of pebble (in plan)	Form of butt			Size-index (in mm)	Thickness : length ratio
	Round.	Pointed.	Straight.		
Flat-based, broad	1	—	1	107—129	1.8—2.0
Flat-based, long	—	—	—	—	—
Rounded, broad	5	—	1	77—146	1.2—1.6
Rounded, long	3	2	—	90—130	1.4—2.0
Total	9	2	2	77.0—146.0	1.3—2.0

In the total number of thirteen chopping tools, only two are made on flat-based pebbles. Both the forms of pebbles are used laterally, as eight chopping tools have working edge on the longer axis. The butt in this case is either rounded or straight. Though the form was noticed in choopers, no flat-based has been worked at its short axis in the chopping tool class. Eleven chopping tools are fashioned out of rounded pebbles, suggesting, that the form was found more suitable for making chopping tool by the Bilaspurians. The longer axis of most of the specimens are converted into the working edge. Five out of six such chopping tools have rounded butt, while the remaining have straight butt. In the category of rounded pebble worked on the shorter axis, three have rounded butts and two pointed. It may be taken note of, that lateral chopping on round pebbles are the biggest and the thickest of all. Contrary to this tbe flat-based specimens of this class tallies with the medium dimensioned chopping tools, but are considerably thin. Exceptionally thin specimens are the rounded pebble long variety, and the smallest is found in the broad and long varieties of the rounded pebble chopping tools.

The form of working edge and the nature of the working of chopping tools are of following types :

Form of edge	Nature of working			Total
	Bold	Small deep	Big shallow	
LATERAL CHOPPING				
Zig-zag edge	3	2	—	5
Straight edge	—	—	2	2
NARROW EDGED CHOPPING				
Zig-zag edge	4	1	—	5
Straight edge	—	—	1	1
TOTAL	7	3	3	13

Most of the specimens of the chopping tool group are typical examples, as ten are worked alternately by bold working, which has resulted in zig-zag edge. In fact all the seems examples of bold working form part of zig-zag edged chopping tools. The remaining three with straight edge are worked by removing big shallow flakes, an for a evidence comparatively careful working than is seen on the earlier type.

There is a clear distinction in the choice of the pebbles for making chopper and chopping tools. Flat-based pebbles are preferred for choppers (70% of the choppers) while the position reverses in the case of chopping tools (except for 15.3%, all the others are made on rounded pebbles). Bold working seems to be essential for fashioning both the classes, the chopper and the chopping tool. Besides, shallow working to be rewarding for making straight edged specimens.

3. *Scraper*

Both the specimens of the scrapers lag behind in the sophistication from the classical forms of scrapers. They are called scrapers, simply because they fulfil the basic requirement of the class *e.g.*, at least one edge should be retouched. More than half the periphary of the flat pebble is worked carefully. These implements, techno-typologically lie between a chopper and a perfect scraper. In case of the other specimen, a big unprepared flake has been retouched on both the sides, which converge into a pointed end. It may be atypical form of the convergent scraper.

4. *Chopper/Core*

The five specimens of the chopper/core category seem to bear unspecific morphological features. For instance, one long or short axis of these retains bold unifacial working, which is a characteristic of chopper. But the high angle flaking on their surface would put them closer to a core of unprepared type. Though a couple of flake-scars appearing on these tally in dimension with the scars seen on the cores, majority of the scars are bigger in size (dimension range being 68-107 mm).

5. *Chopping/Core*

Technically speaking the five specimens of the category of chopping/core, are close to chopping tools rather than cores. But, the nature of working edge confined to one axis does not seem to correspond with a classical chopping tool. For, one surface of the bifacially worked edge, which in most of the cases is the ventral surface, retains a series of flake-scars. From, the other surface one big flake was detached, thereafter. Since the working on the ventral surface is at medium to high angle, the possibility of its being the preparation of a striking platform becomes strong. Contrary to this, not a single corresponding flake was seen in the collection, which obstruct this group's inclusion in cores without reservations.

The dimension counts of the specimens of the two preceding categories, *i.e.*, the chopper/core and the chopping/core, correspond partially. The length-breadth index range of the chopping/core is 102 to 139 mm. Except for two (having 90 and 112 mm size index), all the remaining specimens of the chopper/cores are bigger e.g. their dimension range being 151 to 207 mm. Similarly, the general thickness of the cores and this category has little variation. As is evident from the ratios of the thickness to the longer axis of the chopper/core (1 : 1.7-3.2) and the chopping/cores 1 : 1.6-2.4), that in general chopper/cores are thinner than the other category. However, the dimension of the flake-scars on the two does not correspond in general with one and the other. Except for one on the chopper/core, which has 68 mm as its size-index, the remaining fall out of the range of the flake-scars (59 to 74.5 mm), appearing on the chopper/core. The two smaller ones have 50 and 51.5 mm, while the bigger ones have a range of 90 to 107 mm.

6. *Flake*

The flakes of the collection are marked by the unprepared dorsal surfaced and striking platformed specimens in dominating proportion. The angle between the striking platform and the flake surface of both the specimens are low and their breadth is slightly more than the length (length : breadth being 1 : 1.2). The morphology of these suggests, that they are by products of a process for removing cortex hump from some artefact. On the basis of their dimensions (length-breadth indices being 92 and 99 mm), they can reasonably be associated with fashioning of massive artefacts. Incidentally, massive artefacts are not many in the collection, and it may be noted that the resultant flakes for the majority of chopper-chopping classes, and the intentionally detached flakes corraborating the group of cores are conspecious by their absence.

7. *Core*

Similar to flake group, cores of the Bilaspur assemblage are very limited in number. The four specimens of the group evidence two different tendencies. In the first incident, which is represented by the unprepared cores (two in number), the curvature of the pebbles are exploited for obtaining flakes without any prior preparation. Elongated pebbles with oval cross-section are utilized for producing artefacts of this category. The pebbles are of big dimensions *i.e.*, 112.5 and 130.0 mm dimension-index, and, of moderate thickness (1 : 1.8 and 1 : 2.0 being the ratio between the longer axis and the thickness). Flakes detached from these are of small size (size-index range 40-45 mm). The second technological tendency is seen through a couple of other examples, wherein flakes are taken out in a series in the manner of detaching blades, but, without adopting any specialized way of preparation. Medium sized pebbles (80 and 90 mm) have one striking platform. In one case the striking platform is worked at high angle *i.e.*, 85°-90°, while in the other it remains unworked. Long flakes (ratio between the breadth and the length being 1 : 1.9 and 1 : 1.5) are detached by applying vertical strokes. These flakes are a little bigger than the earlier group, as the size-index range of these is 48.5- 50.0 mm. Not a single specimen corresponding to the cores could be noticed in the collection.

8. *Diverse*

Diverses need elaboration. As referred to elsewhere (Jayaswal. 1978 : 12), the term was suggested by Bordes for such a group, which lacks typo-technological precision. This may include the imperfectly worked specimens or an unexpected type in atypique form in a collection (Bordes. 1961 : 43). In the collection under study, this group comprises three varieties of specimens *i.e.*, (a) worked pebbles, (b) imperfect and incomplete specimens, and (c) atypique burin like artefact.

(a) There are fourteen pebbles which show unconventional flaking and were rejected after a little working. Their rejection was perhaps due to the flaw of the raw material or due to the imperfect process of breaking, which did not break in accordance with the presumption.

(b) Represented by three specimens, these are worked at low angle on both of the short axes. One of the longer side is flaked at medium to high angle. The attempt to work the artefacts thoroughly seems to fail. Thus, the group appears to be the result of an experimental process, which perhaps aimed at producing certain sophisticated artefact class, but, did not come out to be a success.

(c) A flat-based medium sized pebble seems to have a burin edge. Left half of the specimen evidences a natural cleavage while bold working is confined to its right edge. A small flake was vertically detached from the top, which provides a small burin like edge. We hesitate to name this specimen burin, because the single vertical stroke may not be intentional and in the present state seems to be an accidental breakage.

GULER ASSEMBLAGE

The largest collection from the Beas-Banganga valley comes from Guler. Lal has reported fifty-two artefacts, which were obtained from various terraces of the river, around Guler (Lal. 1956). Examination of the same collection, by the present author, brings forth the little divergent typo-technological features of the Guler assemblage than is claimed by Lal.

THE MAJOR ARTEFACT CLASSES

Artefact class	Nos.	%
1. Chopper	27	51.92
2. Chopping tool	3	5.92
3. Unifacial ovate	4	7.69
4. Chopper/core	4	7.69
5. Chopping/core	2	3.84
6. Core	5	9.15
7. Flake	7	13.46
TOTAL	52	99.51

1. *Chopper*

Choppers enjoy the overwhelming majority in the Guler assemblage. A strong tendency for producing this class of implements becomes apparent from the chopper/core group of artefacts and also the small number of chopping tools.

The nature of pebbles utilized for making choppers is as follow :

Form of pebble (in plan)	Form of butt			Size index (in mm)	Thickness: length ratio
	Round	Pointed	Straight		
Flat-based, broad	1	—	4	86-127	1.7-2.6
Flat-based, long	1	3	—	85-134	1.6-3.2
Flat-based, round	5	2	—	88-138	1.5-3.9
Rounded, broad	1	—	5	91-125	1.6-1.9
Rounded, long	1	1	—	80-115	1.8-2.3
Rounded, round	—	1	—	104	1.5
Split-based, broad	1	—	1	90-175	2.1-2.2
TOTAL	10	7	10	80-175	1.5-3.9

The practice of splitting pebble before making chopper is rare. Only two such specimens were noticed, which were worked laterally after splitting of the pebbles. One of it is the largest artefact of the choppers. Flat-based pebbles are preferred to the rounded pebbles (51% and 37% of the choppers). Their size-index marks two sets *i.e.*, the smaller specimens lie within 80 to 91 mm size-range while the bigger ones have more than 115 mm size-index.

The nature of the working edge and the distribution of the type of working on the choppers :

Form of edge	Nature of working			Total
	Bold	Shallow	Medium	
LATERAL CHOPPER				
Convex edge	—	5	1	6
Straight edge	1	2	3	6
Notched edge	2	—	1	3
EDGE ON SHORT AXES				
Convex edge	—	—	2	2
Straight edge	1	—	—	1
Notched edge	—	2	—	2
EQUAL AXES				
Convex edge	—	1	1	2
Straight edge	—	—	2	2
POINTED CHOPPER	2	—	—	2
TOTAL	6	10	10	26

Straight edged choppers is the most frequent form (40.7%) of the class. These are produced in most of the cases with the help of medium type of working, but, in certain cases even bold working could provide such a form. The next form prevalent in this class is the convex edged (36.8%), which was acquired by removing shallow big and medium dimensioned flakes in the respective order. Both the specimens of the pointed chopper variety are the result of bold high angle working (angle range being 80°-85°). It may be noted, that most of the choppers having straight and convex edges are worked at medium angle *i.e.*, 60°-65°, while the notched specimens have slightly steep working angle *e.g.*, 70°-75°. The counts showing preferences for various types of working clearly suggest, that most of the choppers were produced by carefully working the edge, which is indicated by the shallow scars, resulting from light blows and the medium sized flake-scars.

2. *Chopping Tool*

All the three chopping tools are worked on flat-based pebbles. These have considerably big dimensions *i.e.*, size index being 108, 111 and 122 mm. Contrary to the general rule, the chopping tools of this assemblage are made on comparatively thin pebbles *e.g.*, thickness : size index = 1 : 2.2, 2.2 & 3.0. Working edge of the single chopping tool which has working edge on the short axis, is convex. This specimen also has pointed butt. In the remaining two, the one of the larger axis is converted into convex working edge. The butt is either pointed or straight and broad. The technological character of these chopping tool is that bifacial working on these show two distinct angles. For instance, the ventral flat surface is being chipped-off at 25°-30° angle, while the thicker mass of the dorsal face is removed 65°-80° angle. The former is also characterized by shallow neat scars, but, the working on the dorsal face is of bold variety. Thus, the classical zig-zag edged chopping tools are conspecious by their absence in this collection.

3. *Unifacial Ovate*

The four specimens are referred to by Lal as proto-handaxe, and have some assemblance with the Soan type 8 of the Paterson and Drummond's classification. The under surface of these are cortexed with no flaking or a few chipping scars, while the dorsal face is thoroughly worked. The direction of working is from sides to the centres, which form a hump in the middle. Sides are moderately sharp (cross-section is double convexed), one end is pointed and the under surface is comparatively flattish. The specimens are of medium dimension.

4. *Chopper /Core*

The specimens of this group have blunting at one end (angle of flaking 80°-85°). The blunted portion is straight and convex and have been worked carefully by detaching more than one series of chips. Shorter axis of the pebble which are of medium dimension (70-100 mm size-index), is invariably utilized as an edge/platform preparation. In the remaining two specimens, from the flat under surface bold flaking is done in haphazard manner on one of the sides. The pebbles used in this case are comparatively bigger *i.e.*, size-index being 123.5 and 125.0 mm. The longer axis of these are worked. The specimens of the earlier type are thicker (thickness : longer axis ratio = 1 : 1.4 to 1.5), than the latter type (1 : 1.7 to 1.8).

5. *Chopping Tool/Core*

Both of the specimens of this group are bifacially worked at three/fourth of the entire periphary. The working is bold and the pebbles utilized are of medium (86mm) and big (140mm) sizes. The smaller member of the group is comparatively thicker (1 : 1.2 being it's thickness : longer axis ratio) than the bigger one (1 : 1.8).

6. *Core*

The five specimens of core group, on technological grounds are divisible into three sub-groups.

(a) Unprepared core : The medium sized pebbles (100 mm size-index) was exploited for obtaining some non standardized flakes, which is evidenced by the haphazard scars on these.

(b) Core with prepared dorsal surface : An oval pebble of 91 mm size-index is worked on the dorsal surface by removing a few centrally directed flakes. The ventral, however, remains unworked. There is possibility that the specimen is an unfinished prepared core.

(c) Two medium sized pebbles with 80 and 95 mm size index, were used in this case for detaching flakes in series, in the manner of obtaining blades. Striking platform of both the specimens are plain and unfaceted, from which flakes of 50 to 55 mm size-index were detached.

7. *Flake*

The group of flakes of the Guler assemblage is represented by only seven specimens, five of which seem to be the by-products. For their dorsal surface is either cortexed or has a little flaking. Striking platform also is either cortexted or plain flake surface. Two of these have micro striking platform and an unusually low angle between the flake surface and the striking platform. These are characterized by big (125 and 120 mm) and (1 : 5.2, 3.1) bodies. It may be worthwhile to recall, that most of the choppers bear big shallow scars on their working edge. There are three flakes with partially flaked dorsal and striking platform, which could be assigned to the working process of chopping tools. These flakes are smaller is dimension (73.0-86.5 mm) and are also comparatively thicker than the earlier (1 : 2.3, 2.6).

Two flake of the Guler assemblage seems to be intentionally detached, as these were marked by definite preparation marks. They are elongated, and smallest of the flake group (60-65 mm). Their thin body (1 : 3, 3.5), and elongated form (breadth : length ratio being 1 : 1.2), corresponds with the scars on the third category of cores from which long flakes are detached in blade manner. There is, however, no corresponding flake to the second category of cores. Though one would expect a greater quantity of flakes and by-products for corroboration of the varieties of cores and tools, which is lacking in the collection, yet there is in general correspondance between the flake types and a few specific type of cores and also the by-products and the implement categories.

COMPARISON OF THE GULER AND THE BILASPUR ASSEMBLAGES

The pebbles selected for both the assemblages are of approximately similar dimensions and forms. The majority of specimens fall within size-index range 80.0-130 mm, and thickness ratio range 1 : 1.5-2.0.

Flat-based pebbles are preferred for making choppers in both the assemblages. But, choppers are also made on rounded pebbles in both. Splitting of pebble for obtaining one flat surface was not a popular practice, which is in vogue in the Guler tool-kit only.

Both the assemblages lack good representation of core and flake element. The pebble cores from which a few long flakes were obtained in the manner of detaching blade, are noteworthy examples of both the assemblages. This could be taken a characteristic technological feature of the area. A certain proportion of by-products in the tool-kits were the result of chopper-chopping working.

In both the collections choppers preponderate the implement types, and chopping tools occupy a subordinate position.

In spite of these general techno-typological similarities, the two assemblages bear varying characteristics. These are seen particularly in the details of the chopper and chopping tool classes of the Guler and the Bilaspur assemblages. For instance, in comparison to the Guler, Bilaspurian had fashioned varied forms of edges in chopper category. Though straight and convex edged choppers are the most prevalent forms in both, a good proportion of denticulated choppers are noteworthy in the Bilaspur tool-kit. This form is unrepresented in the other. Similarly, though the chopping tools are limited in both, in Guler their classical form *i.e.*, zig-zag edge formed by the bold alternate working, is noteworthy. Incidentally, this form is totally unseen in the other tool-kit. Characteristic feature of the Bilaspur chopping tool technology is its unique way of working *i.e.*, the flat ventral face at low angle and the humped dorsal face at medium to high angle.

III

THE CENTRAL INDIA

The Gangetic plains separate the house of the chopper-chopping occupation area of the north and the north-west from the Peninsula. This dividing zone is sterile in terms of the palaeolithic remains, as it is covered by a thick alluvium of comparatively recent origin. Adjacent to the Ganga-Yamuna plains, is the hilly track of the Vindhyan system, which is the formation of very ancient times. The horizontal spread of this hill series lies within the boundaries of Uttar Pradesh, Madhya Pradesh and Bihar. Number of palaeolithic stations are reported from this belt, particularly in Uttar Pradesh and Madhya Pradesh. However, two types for exclusively chopper-chopping assemblages have come forward from this part. (A) The one which is primarily known from the southern part of Uttar Pradesh, is in the form of collections comming from the surface or the single gravel deposit of rivers. Though these do not claim any significant stratigraphic ascertations, are marked by the absence of the Acheulian element. (B) In the other group can be placed the early stratigraphic occurrences of the Chopper-chopping. These seem to precede the typical Acheulian trait in the valley of Narmada, and the rock-shelters at Bhimbetka, near Bhopal. All these finds are reviewed below.

(A) THE EXCLUSIVELY CHOPPER-CHOPPING LOCALES OF THE SOUTHERN UTTAR PRADESH

HISTORY OF DISCOVERIES

The palaeolithic potentiality of Uttar Pradesh was brought to light about a century ago (Cockburn. 1888). But, it acquired a place on the map of the chopper-chopping in the fifties of the Nineteenth century only. Though Krishnaswami and Soundara Rajan noticed existence of chopper-chopping trait in the Singrauli basin, they have not reported exclusively chopper-chopping locality in the area (Krishnaswami & Soundara Rajan. 1951). Subsequent investigations by Allahabad University, under Sharma, for about three decades, though have brought to light significant finds of the Pleistocene and Holocene periods, the team has not reported either a separate horizon of the chopper-chopping or sites of this category. In early sixties, Pant, for the first time noticed reminiscents of the trait under study in Banda district. The site discovered by him was Lahchuraghat (Pant. 1965 : 8-9). About a decade later, Pant assisted by the present author discovered two more chopper-chopping sites on the banks of the Betwa and Ken rivers (Pant. 1977).

The Singrauli basin is reported to be the 'meeting place' of the Soanian and the Madrasian cultures (Krishnaswami & Soundara Rajan. 1951). The investigators have mentioned 47.2% Acheulian implements and 15% chopper-chopping tools in their collection. But, to the present author the collection seems to retain only the typical Acheulian tradition. As per our earlier studies (Jayaswal. 1978), these proportions are well represented in the Acheulian industries of the Peninsula.

SITES

Lahchuraghat (79°18′ E & 29°19′ N). On the banks of the river Dhasan, and on the slopes of the adjoining hills, artefacts of the chopper-chopping tradition were found.

Bangawan (78° 48′ E & 25° 21′ N). Chopper-chooping tools were picked up from the right bank of the Betwa, at a distance of 14 km east of Jhansi town in Jhansi district.

Belharka (80° 11′ E & 25° 01′ N). Situated in the Naraini *tahsil* of Banda district, the gravel spread of the Ken revealed two cleavers on flake, while on the surface of the right bank was found choppers and chopping tools.

STRATIGRAPHY

No clues regarding the stratigraphic position of the Bangawan and Belharka could be obtained as both of these assemblages were obtained from the surface of the right banks of the rivers Betwa and the Ken. At Lahchuraghat, on the bank of the river Dhasan, a tributary of the river Betwa, a cemented gravel was noticed (Pant. 1965 : 8). The gravel overlying directly on the granite bed-rock was covered by a thick layer of coarse sandy alluvium. Two implements, one chopper and one flake, were obtained *in situ* and two flakes came from the re-deposited layers of the gravel. Later the area was re-examined by Pant and the present author in the year 1976. The aforesaid stratigraphic position of the artefacts was confirmed.

TYPOLOGY

Details of the mentioned tool-kits are available in the Doctoral disseratation of the investigator (Pant. 1977). But, due to the fact that the collections were available to the present author for first hand study the following observations are based on her analysis of the collections.* Artefacts in Belharka collection were just a few, thus, it was not found suitable for detailed study.

LAHCHURA INDUSTRY

The vicinity of the village Lahchuraghat and the Dam on the river Dhasan, has revealed remains of the chopper-chopping, which is devoid of Acheulian element (Pant. 1965). Two localities in the extension of about two kilometres strech were noticable. The artefacts from these also differed on grounds of the techno-typological characters. The investigator has assigned one group to the Lower Palaeolithic facies, and the other with advanced technological features to the Middle Palaeolithic (Pant. 1977). Chopper-chopping made on quartzite pebbles remains the basic culture-component in both of these. Since the present work concentrates on the Lower Palaeolithic phase it is proposed to give details of the earlier industry of Lahchura.

THE MAJOR CLASSES OF THE ARTEFACTS OF THE LAHCHURA INDUSTRY

Artefact type	Nos.	%
1. Chopper	190	55.07
2. Chopping tool	31	8.98
3. Scraper	4	1.15
4. Flake	67	19.42
5. Core	35	10.14
6. Split pebble	13	3.76
7. Chip	5	1.44
TOTAL	345	99.96

Chopper-chopping fare well in the industry (64.05% of the total), and they are the only specific type of implement. For, except for side-scrapers no other form of finished tool is found here.

1. *Chopper*

The most prepondering class of tools, the chopper forms 84.4% of the finished implements of the Lahchura industry. They are made on flat-based, rounded and split pebbles.

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* The collections from Lahchuraghat, Belharka and Bangawan were available to us by the kind Courtesy of Dr. P.C. Pant, in the department of Ancient Indian History, Culture and Archaeology, Banaras Hindu University, Varanasi.

FORM OF THE PEBBLES UTILIZED FOR MAKING CHOPPERS :

Nature of pebble	Form of butt			Size-index (in mm)	Thickness: Length
	Round	Straight	Pointed		
FLAT-BASED					
Long	15	3	22	70.5-114.5	1:1.3-1.9
Broad	1	2	7	66.9-114.0	1:1.7-2.3
Equal axes	25	1	8	66.0- 93.5	1:1.5-2.7
ROUND PEBBLE					
Long	18	2	15	72.5-113.5	1:1.7-2.0
Broad	14	7	14	75.0- 97.5	1:1.7-2.0
Equal axes	13	1	19	55.0- 93.5	1:1.0-2.2
SPLIT PEBBLE	—	2	1	78.0- 80.5	1:1.9-2.9
TOTAL	86	18	86	66.0-144.5	1:1.0-2.9

Round bodied pebbles were utilized more than the flat-based pebbles, for making choppers by the Lahchurians. In only three cases pebbles were utilized before flaking-off the edge. In case of 23.68% of the choppers, the broad axis has been converted into the chopper edge. But, most frequent form is the one which has equal length and breadth axes (35.26%). It may be noted, that only in a nominal proportion, striking dimensional difference between the two axes of the pebbles was noted. For most of the broad and the long specimens have the difference of just 10 to 15 mm. The other noteworthy feature is the rounded and pointed butt forms of the choppers (45.26% each). The straight butt is in general limited in number (9.4%), and is seen frequently in the lateral choppers.

PROPORTION OF THE FORM OF EDGES IN THE CHOPPERS

Form of edge	Nos.	%
LATERAL CHOPPER		
Convex edge	30	15.78
Concave edge	4	2.10
Straight edge	7	3:68
Pointed edge	4	2.10
TOTAL of lateral chopper	45	23.66

(Contd.)

Form of edge	Nos.	%
CHOPPER WITH EDGE AT SHORT AXIS		
Convex edge	48	25.26
Concave edge	2	1.05
Straight edge	12	6.31
Pointed edge	6	3.15
Single stroked	9	4.73
TOTAL of chopper with edge at short axis	77	40.50
CHOPPER WITH EQUAL AXES		
Covex edge	42	22.10
Concave edge	2	1.05
Pointed edge	7	3.68
Straight edge	12	6.31
Single stroked	5	2.63
TOTAL of chopper with equal axes	68	35.77
Grand Total	190	99.93

The most frequent edge form, as per the above table, is the convex edge, which alone forms 63.15% of the choppers. Many of these are marked by step working and denticulation. Nearly half of the choppers have abrupt working (47.36%). In the remainings, 23.68% are worked at very low angle *i.e.*, below 70°, while 28.94% are worked at an angle range of 70°-80°.

2. *Chopping Tool*

The group under study can be divided within a number of classes on the basis of the form of the pebbles utilized.

Form of pebble	Butt form			Size-index (in mm)	Thickness: Length
	Round	Straight	Pointed		
ROUNDED PEBBLE					
Long	4	—	5	58.5-135.5	1:1.6-2.7
Broad	1	2	2	76.5- 90.0	1:2.3-2.5
Equal axes	9	—	8	78.0-113.5	1:1.3-2.3
TOTAL	14	2	15	58.5-135.5	1:1.6-2.3

The noteworthy feature of the chopping tools of the Lahchura is that oval pebbles with a pointed end are converted into chopping tools. The end opposite the pointed end is bifacially worked. Only in 16.12% of the specimens the longer axis has been converted into the working edge. Rounded pebbles are preferred for making of the chopping tools.

THE PROPORTION OF VARIOUS FORMS OF WORKING EDGE

Form of edge	Nos.	%
LATERAL CHOPPING TOOL		
Convex edge	2	6.45
Straight edge	2	6.45
Zig-zag edge	1	3.22
TOTAL of lateral chopping tool	5	16.12
EDGE AT SHORT AXIS		
Convex edge	3	9.67
Straight edge	1	3.22
Zig-zag edge	3	9.67
Pointed edge	2	6.45
TOTAL of chopping tool with short axis	9	29.01
CHOPPING TOOL WITH EQUAL AXES		
Convex edge	5	16.12
Concave edge	1	3.22
Straight edge	2	6.45
Zig-zag edge	8	25.80
Pointed edge	1	3.22
TOTAL of chopping tool with equal axes	17	54.81
Grand Total	31	99.94

Due to the typical alternate working on a good number of chopping tools the prepondering form of edge is the zig-zagged edge. In the remainings convex edge form fares well.

3. *Scraper*

All the four scrapers belong to the side-scraper category. Two each of these are made on flakes and split-pebbles. The retouching on these are however, of medicore type. Both the scrapers on flakes show a tendency for denticulation. The flakes of unprepared and partially flaked dorsal types seem to have more closeness with the by-products than the intentionally detached flakes.

4. *Flake*

The sixty-seven flakes of the industry also include a small group of partly retouched flakes. The four technological categories noticed in flakes are—unprepared (16) ; partially prepared (25); prepared non-Levallois (27), and Levallois (1) flakes. The flakes have in general three clusters within the dimensional indices. The very small group has index-range 30-45 mm; those which are considerably bigger lie between 70-90 mm, and the medium sized specimens have size-index of 55-65 mm. It may be noted that the bigger flakes and the smaller ones do not tally with the dimensions of the cores of the industry. A considerable proportion of these, thus, seems to be by-products. The possibility of utilizing some of the by-products seems to be a plausible explaination, as two such flakes have been utilized as side-scrapers. The flakes of the industry are considerably thick (ratio between the thickness and the length being 1: 2.2-3.0).

5. *Core*

The total number of thirty-five cores show a mixed feature of rudimentary and advanced technological processes. For example the position occupied by Levallois flake core and blade core (31.3%), is little lower than the unprepared and partially prepared flake cores (45. 5%). Besides these, there are three prepared-non-Levallois cores (8.5 %), and four irreguler cores (11.4% of the total cores). The only example of the bladelet core is noteworthy, which is made on cherty quartzite, and in every likely hood it was transported from the other locality from where a more technologically advanced industry was obtained.

The technological picture from the flakes and cores of the industry does not fully correspond. Firstly, the amount of cores would suggest a greater number of flakes in the industry than is found. Secondly, a considerable part of flake group seems to be by-products, and would suggest a less strong tendency to acquire flakes. But, the cores certainly indicate an inclination of the Lahchurians towards obtaining a good amount of flakes.

BANGAWAN INDUSTRY

The right bank of the river Betwa, near Jhansi is the locale of the Bangawan industry. Quartzite pebbles here were used for making chopper-chopping tradition. On the basis of the nature of the pebbles, particularly their size, thickness and the form two categories can be seen. (1) A sizable part of the collection is made of thin, flattish oval pebbles. Both the surfaces in these specimens are almost flat and the sides have convexity in general. The size-index of this group has a range of 58.5 to 97.5 mm, but majority of the specimens fall within the range of 60-70 mm. The ratio between the longer axis and the thickness is considerably increased than the other group (1 : 3.2-4). Though a good proportion is worked at one end or side by neat small flaking in some mark of a diagonal splitting can be seen. This split surface is worked partly by high angle flaking. (2) The other part of the collection is made on pebbles having thick body and well formed butts. Not much variation in the size of this group is found *e.g.*, size-index range 85-95 mm (this excludes one example which has 120 mm size-index). The ratio between their longer axis and thickness though has a range of 1 : 1.1-1.9, most of them have ratio 1.5 or 1.6.

THE MAJOR ARTEFACT CATEGORIES OF BANGAWAN INDUSTRY

Artefact type	Nos.	%
1. Chopper	38	55.07
2. Chopping tool	9	13.04
3. Split pebble	2	2.89
4. Flake	13	18.84
5. Blade	1	1.44
6. Core	6	8.69
TOTAL	69	99.97

Similar to the Lahchurians, the makers of this industry also made choppers in greater quantities, and chopping tools in a limited proportion. Intentionally detached flakes are considerably low, suggesting a tendency of using raw material in its core form for making tools, rather than converting flakes into tools.

1. *Chopper*

FORMS OF BUTT AND NATURE OF THE PEBBLES USEN FOR CHOPPERS

Nature of pebble	Form of butt Round	 Straight	 Point	Size-index (in mm)	Thick-ness: length
FLAT-BASED					
Broad	1	2	2	88.0-95.0	1: 1.1-1.4
Long	4	—	2	90.5-92.5	1: 1.3-1.9
Equal axes	5	—	—	78.0-108.0	1: 1.2-1.8
ROUND PEBBLE					
Broad	1	—	1	84.5-90.0	1: 1.5-1.6
Long	5	2	2	85.0-120.0	1: 1.3-1.5
Equal axes		—	1	87.0-90.0	1: 1.05-1.5
BOTH SURFACE FLAT	8	—	—	58.5-97.5	1: 3.2-4.0
TOTAL	26	4	8	58.5-120.0	1: 1.1-4.0

Flat-based big pebbles are preferred for making choppers. These are with round, straight or pointed butts. In the round pebbles and the flattish pebbles the most frequent form of butt is round. Since on plan the flattish pebbles have round or oval shapes, they invariably show round butt. This group of specimens, both on the basis of the flat nature of the pebbles and neat working, seems to combine morphology of the chopper and scraper categories.

Most of the choppers are worked at high angle *e.g.*, more than 80°. This mode is particularly common in the rounded pebbles, and those made on the pebbles having both the surfaces flat. Eight specimens are worked at medium angle *i.e.*, 70°-80°, and six at an angle below 70°.

TYPES OF EDGE-FORMS OF THE CHOPPERS

Form of edge	Nos.	%
LATERAL CHOPPER		
Convex edge	1	2.63
Straight edge	1	2.63
Convex edge	7	18.42
Single stroked	6	15.78
TOTAL of lateral chopper	15	39.46
EDGE AT SHORTER AXIS		
Concave edge	2	5.26
Straight edge	3	7.88
Convex edge	8	21.05
Pointed edge	1	2.63
Single stroked	1	2.63
TOTAL of chopper with edge on short axis	15	39.45
CHOPPER WITH EQUAL AXES		
Straight edge	4	10.52
Convex edge	3	7.88
Single stroked	1	2.63
TOTAL of chopper with equal axes	8	21.03
Grand Total	38	99.94

Most frequent form of edge is the convex, which is followed by straight and concave. Single stroked choppers also fare well, while there is only one pointed chopper.

2. *Chopping Tool*

The group of nine chopping tools are made on bigger pebbles (size-index range 77.5-95.0 mm). In comparison to the flat-based, round pebbles were found suitable for this class. As only three are made on flat-based and six on round pebbles. The former is characterized by the working which has two different angles *e.g.*, the flat under surface being worked at medium angle, while the flaking on the other surface is considerably low 50°-60°. Typical alternate working is lacking. These specimens are characterized by long body and pointed butts. The medium angled flaking is represented by small, shallow neat scars, while the other is characterized by big shallow scars.

THE FORMS OF EDGE OF THE CHOPPING TOOLS

Form of edge	Nos.	%
LATERAL CHOPPING TOOL		
Concave edge	2	22.22
Straight edge	1	11.11
TOTAL of lateral chopping	3	33.33
CHOPPING TOOL WITH EDGE AT SHORT AXIS		
Concave edge	1	11.11
Convex edge	1	11.11
Pointed edge	2	22.22
TOTAL of chopping tool with edge on short axis	4	44.44
CHOPPING WITH EQUAL AXES		
Covex edge	2	22.22
Grand Total	9	99.99

Since the number of the chopping tools is not sufficient there does not emerge a definite pattern in the distribution of the form of edge.

3. *Split Pebble*

The small oval flattish pebbles have a diagonal splitting. There is no secondary working on them, but, since the worked specimens of the type are found we take these two specimens as the result of international splitting, after which these were left incomplete.

4. *Flake*

In the group of thirteen flakes only two are partially retouched. Three types of morphological characters are found in them. These are of unprepared (6); partially prepared (6), and prepared non-Levallois (1) types. The flakes of both the earlier types seem to be the result of the chopper making. The real flake element is negligible in the collection. Some of the by-products were utilized as scrapers. It is possible to postulate this from the two partly retouched unprepared flakes.

5. *Blade*

There is only one blade which has cortexed dorsal surface. Though the form just fulfills the basic definition of the blade as far as the length-breadth ratio is concerned, it is not marked by the specific way of preparation for a blade. Thus, this also is a preparatory blade.

6. *Core*

The group of six cores is divisible within three types *viz.*, unprepared core (2); partially prepared core for obtaining flakes (3), and core for detaching blade. The latter has a prepared ridge but it was abundoned in unexploited condition. Blade detaching technique was thus in practice in the industry.

The typo-technological characters borne by Lahchura and Bangawan industries have close affinities. The only striking variation between the two is the profuse use of flattish pebbles in the case of the Bangawan, which is not present in the other.

(B) THE EARLY STRATIGRAPHIC OCCURRENCE OF THE CHOPPER-CHOPPING, IN MADHYA PRADESH

BHIMBETKIAN

Lately, a group of more than seven hundred and fifty rock-shelters have come into prominence. These are situated between Obaidullahganj (Hirania) and Barkheda stations on the Bhopal-Itarsi railway line of the Central Railways. Situated at a distance of about 45 km south of Bhopal, the capital town of Madhya Pradesh, the group of shelters at Bhimbetka (77°37′ E & 22°5′ N), are known for numerous paintings of the prehistoric times. Besides, almost a continuous sequence of the past cultures from the Early Stone Age to the late Medieval times have been obtained from these.

Bhimbetka group of shelters were discovered by V.S. Wakankar in the year 1957. A number of teams from various institutions, thereafter, investigated the area. Noteworthy among these are the team of Sagar University, which under the guidance of K.D. Bajpai exposed the microlithic horizons in two of the shelters in the year 1971 (Ref. Misra, Mathpal & Nagar, 1977 : 7). Subsequently, a series of excavations were conducted by V.S. Wakankar with the team of the Vikram University, Ujjain (*IAR 1971-72* : 30-31; *IAR 1972-73* : 18-19; *IAR 1974-75* : 24-25). and also by V.N. Misra with the team of the Deccan College, Poona (*IAR 1972-73* : 19; *IAR 1974-75* : 25-26). The excavations by Wakankar and Misra have brought to light cultural remains of the Pleistocene and the Holocene peoples.

In one of the shelters, III F-24, the lowermost implementiferous levels noticed by Wakankar revealed,... "choppers of various sizes made on natural pebbles" (*IAR 1971-72* : 30). The chopper assemblage named 'Bhimbetkian', is separated from the overlying Acheulian horizon by a sterile layer of fine reddish earth (Wakankar. 1973). While commenting upon the relationship of the chopper assemblage with the succeeding facies Wakankar postulates that, "Though no clear evolution of Acheulian from pebble tool technology has been noticed at Bhimbetka in digging, there are other sites such as open camp sites near Barkheda (Raisen Dist., M.P.) (Jawad and Rampura, Mandsaur Dist., M.P.), Punjapura (Dewas Dist., M.P.), Agar (Shajapur Dist., M.P.), Ramgad-Khedighat (Indore-Khargine Dist., M.P.), where a clear evolution of Acheulian bifaces from pebble tools has been studied" (Wakankar. 1976 : 15). However, it is difficult to visualize this claim, since the morphological and other details of the referred to situation are not available in the published accounts (Wakankar. 1973 ; 1976), nor could the present author study the collection.

The excavations in the shelter III F-23, by Misra do not fully support discoveries made by Wakankar. Here, the evidence for Bhimbetkian, is particularly unrepresented and the sequence starts from the Late Acheulian remains (*IAR 1974-75* : 25-26). Besides, Misra's categorical remark regarding the absence of the pebble tools even from the Acheulian levels are significant (Misra. 1974). Though the possibility of the Waknakar's claim as genuine, needs further detailed investigations for confirmation, its possibility can not be ruled out totally.

THE NARMADA VALLEY

The other two claims of the early stratigraphic occurrence of the chopper-chopping in Madhya Pradesh, *e.g.*, the Mahadevian and the Durkadian are located in the valley of the river Narmada. Originating from Amarkantak, in the Maikal range, it empties into the Gulf of Cambay. During its east-west flow it has exposed Deccan Trap, which is the basal composition of the valley. Lying above it are the alluvial deposits of about five hundred feet. Though known for enshrining the classical Acheulian sites, a pre-Acheulian chopper-chopping phase was claimed at Mahadeo Piparia and its vicinity and the Durkadi nala, near Maheshwar.

As early as 1873, the valley of Narmada is reported to have yielded remains of mammalian fossils along with palaeolithic artefacts. The potentiality of the area was further highlighted after the discoveries made by the Yale Cambridge Expedition of 1935 (De Terra & Paterson. 1939). Fifteen years later the lower valley was surveyed by Zeuner, who tried to interpret the geo-chronology of the area (Zeuner. 1950). Since then, a series of investigations were conducted in this part. For instance, Sankalia and Subbarao examined the area of West Nimar district (*IAR 1958-59* : 29-30; *IAR 1959-60* : 22), and Sen surveyed the area between Amarkantak and Hoshangabad (*IAR 1960-61* : 13-16). While these investigators were busy in establishing the river deposit sequence, Joshi preferred to excavate a rock-shelter in the adjacent region. His work was confined to Adamgarh rock-shelter (*IAR 1960-61* : 13). Later, Supekar and the team from Deccan College, re-investigated the area surveyed by Khatri, since some of the claims by the later arose controversy (*IAR 1962-63* : 11; *IAR 1963-64* : 14; *IAR 1964-65* : 16). Besides, an occupational floor of pebble culture was exposed by Armand and the Deccan College team, on the sides of Durkadi (*IAR 1970-71* : 20-22). Since only Khatri's claim and also perhaps the discoveries by Jorge Armand lie within the perview of the present section, they are briefed below.

SITES

Hasalpur (77°22′ E & 22°05′ N). Seven artefacts of chopper-chopping tradition were obtained *in situ* from the pebbly cemented gravel by Khatri.

Kankarghat Hoshangabad (77°55′ E & 22°55′ N). Seventeen artefacts of the chopper-chopping types were found to be associated with the pebbly cemented gravel, by the same investigator.

Mahadeo Piparia (80°02′ E & 23°00′ N). The lower most deposit, the red clay, here has yielded the largest collection of the Mahadevian (Khatri. 1962).

Murgakhera (80°03′ E & 23°00′ N). From a similar deposit artefacts made on pebbles were discovered.

Durkadi-Maheshwar (75° 36′ E & 22° 09′ N). A big collection was made from the boulder deposit of the Durkadi nala, a small tributary of the river Narmada, in the Nimar district.

MAHADEVIAN

In his first surveys the upper reaches of the river Narmada, between Amarkankta and Harda, Khatri obtained palaeoliths from Gravel I, which was found resting over a sterile layer of 'Red clay'. Khatri concluded that, "There is nothing like a stratigraphic evolution in the Narmada palaeolithic industry" (*IAR 1958-59* : 27). But, in subsequent years he reversed his opinion. For while surveying the area between Barmanghat and Jhansighat in Narsinghpur district, he procurred remains of ..."the earliest Phase of the Cheallan and illustrating the evolution of the handaxe from the pebble to the earliest Abbevillian stages" (*IAR 1959-60* : 22). The Red clay, the earliest formation of the area was ascertained as the primary context for the Mahadevian assemblage, though they were also found associating the later deposits. Thus, suggesting a continuity in the succeeding phase. The Clactonian technique and the chopper-chopping of the earliest implementiferous deposit, were also seen in the Gravel I, which lies against the Red clay (Khatri. 1963 : 186-188). Cemented gravel, which is the next gravel deposit, however, revealed early Middle Acheulian implements (Khatri. 1963). Whereas, the Yellow sand was the horizon for the Late Acheulian and the Series II tool traditions. The four localities of Mahadevian, discovered by Khatri are—Hasalpur, Kankarghat, Mahadeo Piparia and Murgakhera.

Khatri's description of the tool-kits of the Mahadevian tradition suggests, that the implements were made on flat pebbles in general. Besides flat pebbles, round and oval pebbles were also used for making chopper-chopping tools. Most of the artefacts are marked by heaviness, evidencing an early nature of the collection. The smaller group of artefacts are of cricket ball size (Khatri. 1963 : 191). The unifacial or bifacial flaking on these are characterized by deep and large flake-scars with prominent point of contact, which apparently evidence the application of block-on-block technique. Amidst the usual chopper and chopping tools there are a few specimens which are taken to be the pro-genitor of handaxes. This assemblage was named Mahadevian after the type site Mahadeo Piparia, and was claimed to provide evidence like Oldowan of East Africa. It is worthwhile to recall Khatri's conclusions that, "These chopper-chopping pebble tools appear to represent the base from which the Indian Chelles-Acheul culture sprang and evolved stage by stage" (Khatri. 1963 : 196). The date assigned to this group of artefacts was a very early phase of the Middle Pleistocene.

In the very next year of the recognition of the Mahadevian, doubts were raised regarding the authenticity of the dating, and also, claimed typo-technological development of the Oldowan type into the Acheulian (Misra & Mate. 1965 : 10-12). In the Seminar on Indian Prehistory, held at Poona, in the year 1964, Misra mentioned the discoveries by Khatri, and compared his own field observations on the same region with that of the claims made by Khatri. He emphathetically negated the existence of the Mahadevian horizon and also held opposite view regarding the Oldowan like development in the valley of the Narmada. The pertinent points raised in this direction were, that the handaxe culture in India may be as late as the Last Glaciation as proposed by Zeuner and Wainwright (Misra. 1965 : 11). And, this date obviously is very late in comparison to the situation in the East Africa. A parallelism between the Narmada and the Olduvai Gorge may not, thus, be justified. Somewhat similar reservations were expressed by Gupta, who made a plea not to rely much on prepondering position of the chopper-chopping for building such an hypothesis, as this could be ... "an extremely risky criterion for calling it 'Oldowan,' " (Gupta. 1965 : 12).

The field investigations around Mahadeo Piparia, seem to confirm the doubts raised in the Seminar on Indian Prehistory. The excavations by Supekar indicated that the earliest deposit at the locality is the Boulder conglomerate and not the Red clay, as was claimed by Khatri. The Boulder conglomerate has yielded, implements of both the Lower and the Middle Palaeolithic traditions (*IAR 1964-65* : 16). On the basis of this, even the stratigraphy does not support the supposed separation between the Lower and the Middle Palaeolithic. Thus, the stage by stage evolution of the Chelles-Acheul, is far fatched.

DURKADIAN

On the banks of the Durkadi nala, a small tributary of the river Narmada, Jorge Armand exposed an occupational floor of the chopper-chopping using people. To cite the excavator, "The tool-kit was basically made up of choppers both unifacial, and bifacial, big and small side-scrapers, some rare discoids, scrapers made on flat pebble, a lot of unworked flakes and chips, and a relatively large number of cores both on pebble and on flake" (*IAR 1970-71* : 21). This pre-Acheulian phase is succeeded by the developed Durkadian, which besides having the characteristic types of Durkadian tradition also contained typical Acheulian implements, but in less advanced stage. The Boulder conglomerate deposit yielding the Durkadian, is superimposed by a silt, which is devoid of artefacts. The silt has been dated to the second interpluvial, while the implementiferous gravel is dated to the second pluvial (Armand. 1980). The former is taken to be contemporary with the second interglaciation and the other with the Mindel Glaciation.

The aforesaid interpretation has two lacuna. Firstly, the basis for division of the Durkadian within the two typo-technological phases is not very well marked by the stratigraphic account. Secondly, it is obvious to most of us that the correlation between the pluvial and glacial cycles of the Pleistocene times, is not yet established on firm grounds, which has been adopted by the investigator without reservations.

The gravel deposit has been separated into two parts by the investigator. The upper part is said to have yielded an early Abbevillian industry, named as developed Durkadian, while the deposit below 35 cms, contained Durkadian, a group of artefacts akin to the Oldowan (Armand. 1980).

The major categorization of the tool-kit is in the form of 'Heavy duty' and 'Light duty' tools. The group of heavy duty comprises of the artefacts weighing more than 400 grams, while that of light duty weigh less than 400 grams. Another group, 'Complex tools', is represented by ..."tools bearing two or more types of active zones; for instance a chopper bearing a side-edge and an end-edge together" (Armand. 1980 : 247). Chopper-chopping fall within the heavy duty, while scraper etc., form part of the light duty tools. The typo-technological categories found within the finished tools, both in rolled and fresh conditions are the following :

HEAVY DUTY TOOLS	Fresh	Rolled	Total
Chopper	37	23	60
Proto-cleaver	1	—	1
Proto-handaxe	1	—	1
Handaxe	6	—	6
Complex	4	2	6
Miscelleneous	—	5	5
TOTAL	49	30	79
LIGHT DUTY			
Scraper	46	28	74
Borer	6	2	8
Burin	1	—	1
Complex	10	18	28
Miscelleneous	8	—	8
TOTAL	71	48	119
Flake	131	158	289
Core	51	24	75
Grand Total	302	260	562

Durkadian A —Rolled group of implements form such a collection, which according to the excavator is characterized by Oldowan stage. It may thus seem to belong to our exclusively chopper-chopping tradition. Appearance of Acheulian fossil types is emphathetically denied in this stage. The flakes and cores of both the prepared and unprepared varieties are found, and there are sixty-three waste-products.

Durkadian B —This phase seems to contain a limited number of Acheulian implements. Though, the investigator has noticed proto-handaxe and cleaver, there are also finely worked handaxes and borers, which would suggest a considerably advanced knowledge of tool fabrication technique than is claimed.

Examination of the same collection by the present author,* who also had an opportunity to participate in the excavation for a short period, suggests that it would need a coutious accumulation of data and interpretation of the stratigraphic and typological aspects which lack conviction at present. There is not enough evidence for the division of Abbevillian and Acheulian culture-stages in this sub-continent. Likewise the distinction between the two phases in the single deposit was not so marked as is claimed by the investigator.

It would not be out of place to record observations of the present author on the lithic collections from Narmada region. Our study suggested that within the early palaeolithic industries of this area, two techno-typological groups existed (Jayaswal. 1978). In one case pebbles were utilized in profusion with a considerable percentage of chopper-chopping element. Mahadeo Piparia distinctively show such a tendency. But, though in a lower proportion, the handaxe-cleaver element is also well represented in it. In the other group typical Acheulian industry come. In this case well worked Acheulian artefacts are seen in considerably good proportion, and the chopper-chopping element is poorly represented. This group is reported from several sites like Hoshangabad, Narsinghapur, Adamgarh etc. Durkadian industry seems to retain features of the first group, wherein the Acheulian element is subordinated by the chopper-chopping.

The above account clearly suggests, that an earlier stratigraphic context for the chopper-chopping tradition giving rise to the Acheulian technology, is yet to be ascertained, and all the three claims in this regard are not acceptable without reservation.

IV

THE DECCAN

Composed of Pre-Cambrian formations, such as the Archean, the Chronockite, the

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*Both the opportunities were available to us by the kind Courtesy of Dr. Jorge Armand.

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Dharwar and the Cuddapah systems, the landmass of the Deccan is of very stable nature. For, inspite of the weathering and erosional activities of the outer crust, the general morphological character of the region remains, by and large, unchanged. The striking feature of this land-mass is slight tilt from the south and the west to the east. It is this aspect which governs the flow of almost all the important river systems of this region, most of which originate from the high lands of the west and run down into the Bay of Bengal. As referred to earlier, exclusively chopper-chopping sites, in this region, are rare and sporadic. Their concentration can be seen in the main land of Maharashtra, Konkan and Mysore.

A. MAHARASHTRA : MAIN LAND

Being an integral part of the Deccan plateau, the main land of Maharashtra is characterised by the general geo-morphological features of the Deccan, which are mentioned above. Drained by two main river systems *i.e.*, the Godavari and the Krishna, the entire region is traversed by these rivers and their numerous tributaries, which run from the west to the east.

Though the history of palaeolithic research is very old in the main land of Maharashtra, the finds of the exclusively chopper-chopping, is of considerably recent times *e.g.*, early sixties of this century. Explorations in the parts of the districts Chanda, Poona and Satara of the years 1961 and 1963, have revealed traces of the exclusively chopper-chopping trait. During the course of the survey, Srinivasan found the three tributaries of the Wainganga *viz.*, the Pranhita, the Indravati and the Kathani retaining chopper-chopping, without a trace of the Acheulian element (*IAR 1961-62* : 30). Similar to these, are the finds from Poona and Satara districts, which were obtained from the Mula and Krishna rivers (*IAR 1962-63* : 15-16). These discoveries were made by Sankalia, Majumdar and Rajguru, and Pappu in the respective areas.

SITES

The following sites from Chanda district were reported, which were situated on the river Pranhita.

Abanpalli
Arkapalli
Charpalli
Chichgundi
Dhamaran
Lingampalli
Mohangaon-Budrukh
Mariyudem
Mudumtorna
Nandigaon

Gadahiri
Galakhurji
Indaram
Jhamela
Kanepalli
Kathapalli
Kolpalli

Lakameta

Pusukpalli
Rajpalli
Repanpalli
Timram
Temramith
Virampalli
Wangepalli

Bramragarh	It is situated on the bank of the river Indravati in the same district.
Dhanora-Darachi *Rajoli* *Sale Bhatti*	These sites were located in the valley of the river Kathuni in the Chanda district.
Dattawadi	From the banks of the river Mutha in the Poona district two choppers and choppings were obtained.
Chandoli	In the gravel of the river Ghod, in Poona district two choppers were found.
Limb (74°03′ E & 17°47′ N) *Mhuli* *Mardhe* (74°01′ E & 17°48′ N) *Pachwad* (74°00′ E & 17°52′ N) *Songaon* (74°06′ E & 17°43′ N)	The river Krishna in the district Satara enshrines all these sites from where choppers and flakes were obtained.

STRATIGRPHY

The sediments of the Wainganga system, in the Chanda district, is represented by the section noticed around Papamiya-Tekdi. The sandstone and variegated shale-beds, here is superimposed by a conglomerate-bed. All the three are pre-implementiferous deposits. For, stone artefacts and silicified wood fossils were obtained from the wash out debris of a rubble-gravel layer, which overlies the conglomerate bed (*IAR 1961-62* : 30). But, at Dhanora the artefacts were found from the gullies exposing the lateritic formation. It is, however, difficult to ascertain the real nature and significance of this deposit.

The Chandoli section on the river Ghod seems to be significant for the Middle Palaeolithic tools, for, "...the gravels of the Early Stone Age being not encountered in the explored area" (*IAR 1962-63* : 15). The choppers were obtained from the loose gravel of the river bed. But, at Dattawadi in Poona, evidence for two cycles of erosion and deposition was noticed by Sankalia, on the Mutha river (*IAR 1962-63* : 16).

The choppers and flakes reported by Pappu, in Satara district, were found lying in the loose gravel of the Krishna river (*IAR 1962-63* : 16). Mardhe is referred to as Middle Palaeolithic site in the later report (Pappu. 1974), while Mhuli is not mentioned in it. Only one chopper is reported from Songaon, which is un-associated with Acheulian (Pappu. 1974 : 52).

TYPOLOGY

The details of the exclusively chopper-chopping tool-kits of the mainland is not available. The twelve specimens illustrated from Kattur, Timram, Abanpalli, Wangepalli and Mudumtormu of the Chanda district, are made on shale and seem to belong to chopper and chopping tool categories (*IAR 1961-62* : Pl. LB). Dolerite is used for the tools of the Poona district. Due to a particular type of chemical weathering of the Deccan trap of the area, dolorite formations are broken in round chunks, which in appearance resembles well with a water borne pebble. The artefacts from Dattawadi and Chandoli are made on such specimens. One chopper and a couple of flakes and cores reported from Satara district are made on quartzite.

The aforesaid discoveries though suggest that chopper-chopping tools were discovered in Maharashtra, without being associated with the Acheulian element in small pockets, yet they cannot legitimately be taken to represent the chopper-chooping element. Because, the number of artefacts acquired from these are too small, and also, none of the investigators has referred them as isolated chopper-chopping pockets. Besides, the neighbouring areas like Chanda district (*IAR 1960-61* : 22), and Bhandara district (Joshi. 1972 : 44), have revealed definite traces of Acheulian complex, which are also associated with chopper chopping tools. Thus, there is a possibility that the mentioned collections are incomplete and may form part and parcel of the traits found in Chanda and Bhandara districts, when increased through proper investigations.

B. KONKAN—THE COASTAL MAHARASHTRA

Quite a few chopper-chopping implements are discovered in Konkan. This area is marked by the coastal ecology. As per Joshi and Bopardikar, the physiography alongwith the climate and vegitation of this area differs basically from that of the main land of Maharashtra (Joshi and Bopardikar. 1972 : 47). The latter being an integral part of the Deccan plateau, is composed of extensive plateau-surface, whereas, the area under discussion comprises series of hill-ranges and laterite compositions. In contrast to the inner land, which has mighty rivers the drainage of Konkan is in the form of short coursed rivers originating from the west facing Sahyadrian scarps of the Deccan trap. Three of the rivers, namely, the Kajvi, the Gandhari and the Savitri, draining the Kolaba district are noteworthy.

The survey of the river valleys around Mahad, Pachad and Ratnagiri by Joshi and Bopardikar, has brought to light nine chopper yielding localities (*IAR 1969-70* : 23; Joshi and Bopardikar. 1972 : 48-50).

The earlier palaeolithic finds concentrated around Bombay. Initiated by Todd, who reconstructed the Pleistocene sequence at Khandivli and Borivli, around Bombay (Todd. 1939), the area was examined subsequently by Malik and Sankalia. Todd had claimed horizons for Clactonian, which was succeeded by Chellian tools associated with the Clactonian flakes. This claim was negated by Malik (*IAR : 1957-58* : 78; Malik. 1957), and Sankalia (*IAR 1960-61* : 22; Sankalia. 1962). Comparatively recent explorations in the coastal land of Maharashtra by Rajguru and Guzder and Joshi and Bopardikar have brought to light reminiscents of exclusively chopper-chopping localities in the districts Ratnagiri and Kolaba (Guzder. 1975; Joshi and Bopardikar. 1972). Not many artefacts could be obtained from the eleven localities discovered by these teams.

SITES

The sites reported by Joshi and Bopardikar are the following :

Rajvadi (73°27' E & 18°15' N). The higher terrace of the two terraces on the river Savitri, in the Kolaba district is noteworthy.

Kamble (73°28′ E & 18°04′ N). Two choppers were pickedup from the cliff section of the Savitri, in the Kolaba district.

Turmbhe (73°29′ E & 18°00′ N). Two choppers were obtained from the pebble-bed of the Savitri in the Kolaba district.

Charai (73°28′ E & 17°59′ N). The left bank of the river Savitri, lying within the boundaries of the Kolaba district has yielded two choppers.

Pachad (73°24′ E & 18°14′N). An unifacial chopper was found here.

Sakharpa (73°41′ E & 16°59′ N). One chopper was found from the confluence of a tributary nala with the Kajvi river, in the Ratnagiri district.

Harchiri (73°26′ E & 16°56′ N). A proto-handaxe was picked up from the left bank of the Kajvi river in the Ratnagiri district.

The following four sites are the reportings by Rajguru and Guzder.

Kuperichi Ghat (73°36′ E & 16°04′ N). The locality has yielded thrity-three artefacts.

Salel (73°36′ E & 16°04′ N). Twenty-four artefacts were recovered from this locality.

Chowke Nullah (73°35′ E & 16°03′ N). A total of eighty-seven artefacts were obtained from here.

Hadi (73°31′ E & 16°09′ N) Situated on the river Ghod, the locality has yielded sixty-five artefacts.

STRATIGRAPHY

The pebble-bed of the area is implementiferous. Both in its *in situ* position, which was observed in high terrace of the Savitri at Rajvadi, and, lower deposit in the cliff-section of the Savitri at Kamble and Turmbhe, the Kajvi at Harchiri and Sakharapa etc., and, the wash out deposit in the form of loose gravel in the river beds, it has revealed a considerably limited number of artefacts (Joshi & Bopardikar. 1972 : 48-50).

TYPOLOGY

Joshi and Bopardikar have not mentioned exact number of the artefacts obtained from the seven localities. It seems most of the specimens of their collection are worked out of pebbles and two choppers are fashioned on blocks. From the descriptions of the illustrated artefacts, it becomes apparent that both flat-based and rounded pebbles were utilized for making choppers (Joshi & Bopardikar. 1972 : 51). There is, also the mention of a split-pebble. The pebbles are worked both on the longer axis—the lateral variety, and the short axis —the narrow edge type of our classification. Besides, most of the illustrated specimens have straight wide butts, though there are a couple of examples of the narrow long butts also. Convex edged and the denticulated specimens seem to be in significant proportions **The** working on these are said to be at 60°-85° angle, which is of neat appearance evidencing technological skill. There are four unretouched flakes, and two proto-handaxe and unifacial handaxe. Investigators make a categorical statement that, "No tools showing definite handaxe or cleaver forms has been found and the two specimens ...which may be a proto handaxe and unifacial handaxe on flake, would be taken as provisional types" (Joshi & Bopardikar. 1972 : 50). The nature of evidence in this case is also very scanty, still this group can tentatively be assigned to the exclusively chopper chopping tradition.

The eleven specimens illustrated by Guzder form only 6.8% part of the finished tools (total 75), which it self is less than half of the total artefacts (1 : 2.7 being ratio of the finished tool : total). The chopper and chopping tools are made on flat-based, rounded and also ridged based pebbles. The quartzite pebbles are worked by shallow scars both on the long and short axes. The convex edge, and straight edges seem to be the most common forms. There are also a few peripheral and denticulated choppers. The typo-technological features borne by the collections made by Joshi and Bopardikar, and that of Guzder seem to be similar to each other.

C. MYSORE

Only one exclusively chopper-chopping locality has comeforth so far from Mysore State. This is the site of Nittur, which marks the southern most station of the tradition under study. Situated in Bellary district, it was discovered by Ansari. The area is formed by the Dharwar system and the Peninsular gneisses of the Archean formation, and is traversed by the river Tungbhadra and its tributaries, which empties into the river Krishna.

The history of the palaeolithic finds of the area goes back to the times of Foote, who is referred to have collected implements (Sankalia. 1962 : 32). The subsequent investigation by Seshadri in the Tamkur district is noteworthy for Acheulian tools (Seshadri. 1955). The isolated example of the exclusively chopper-chopping is discovered by Ansari (*IAR 1963-64* : 24).

Nittur (76° 53′ E & 15° 32′ N)—Situatad at a distance of five kilometres from Takkalkotta in the Bellary district, the right bank of the Tungbhadra was found promising. The chopper-chopping tools here were found along with the mineralized fossil bones of *Bos namadicus*, a Middle Pleistocene faunal species.

Between the two sediments— the 35 cms thick gravel and the overlying sub-recent soil, the gravel seems to have yielded the earlier group of tools (Ansari. 1972 : 2).

The collection of tools from Nittur, are divided within two groups on the basis of typology ... "and to some extent stratigraphically, but no clear stratigraphic evidence is here" (Ansari. 1970 : 2). Fashioned out of basalt/dolerite, the total number of 31 artefacts of the 'Soan type' have been screened by the investigator within four heads *i.e.*, chopper—11, chopping tool—13, flake—2, and reject—5.

Cursory examination of the Nittur assemblage by the present author, suggests that most of the choppers (six out of ten) are made on rounded pebbles, while two pebbles-were split before the conversion of choppers.* The chopping tools are made on comparatively bigger pebbles and the working on them are considerably bold. Seven such specimens were noticed in the collection. Most of the choppers have convex and straight edges. Both the long and short axes are worked. Pointed chopping and denticulated chopping were also noticed.

The most striking feature is the association of discoid and the Levallois cores. The flakes are big (dimension 23.0 mm), and small (15 mm) and show some working prior to their detachment from the parent core, these could not be associated with the technological refinement of the cores. In the group of unprepared flakes retouching is invariably present. The typology and the technological features of the Nittur assemblage may suggest, that if there is any similarity between the present assemblage and the Potwar region chopper-chopping, it could only be with the late facies. However, Ansari's remarks may be recalled, who seems to support Sankalia that, "... there might be a possibility for the independent origin of pebble tool at Kurnool, as they share a major representation (about 40 percent) in the total assemblage. The present evidence from Nittur adds some more weight to his observations" (Ansari. 1970 : 7). Such a postulation is difficult to ascertain at the present state of knowledge.

RESUME

The salient features, which emerge from the above account are given below :

Distribution pattern of the exclusively chopper-chopping locales indicates a concentration in the north-western and northern parts of the Indo-Pakistan sub-continent. Density of such localities decreases considerably as one moves from the Potwar region to the east and the south. For instance, the Potwar and the northern region have good amount of such localities, while only a few of the sites of the Central India and a single one from the Deccan would belong to this category.

It may be noted that the artefacts reported from most of the sites discussed here, are limited in quantity. This situation holds good for all the four regions. The comparatively bigger collections like those of Lahchura are derived from the surface, or in other case are of a later date like the Upper Soan group of artefacts of the Potwar region. It is possible to explain the absence of larger collection of artefacts in two ways. Firstly, it appears, that a small section of the population was involved in the production of the chopper-chopping classes and a few crude scrapers. Secondly, that, the so far acquired culture remains are partial representation of the total lithic products of the time. Apparently, the culture debris of the exclusively chopper-chopping tool makers is yet to be discovered *in situ* from habitational localities. In the present state, it is

*The collection was available to us in the Deccan College, Poona, by the kind Courtsey of Dr Ansari.

however, difficult to choose one of the two, for providing a certain explanation to this situation.

The most striking typological feature of the exclusively chopper-chopping trait is the very high frequency of the choppers and sub-ordination of the chopping-tools. Thus, the unifacial working was more in vogue than the bifacial flaking. The present data further suggests, that the tendency to produce chopper was stronger in the nucleaus area of the exclusively chopper-chopping trait, which seems to diminish respectively in the Central India and the Deccan.

The proportion of the chopping to chopper in the representative tool-kits convincingly illustrates this feature.

Area	Site	Ratio of Chopper : Chopping
The Northern India	Guler	8 : 1
	Bilaspur	3 : 1
The Central India	Lahchura	6.12 : 1
	Bangawan	4.22 : 1
The Deccan	Nittur	1 : 3

The only exception in this regard is Bilaspur, which has a lower ratio than the excepted proportion of the choppers to the chopping tools.

A distinct preference in the selection of the raw material for chopper and chopping classes seems to be prevalent in the tradition under study. Flat-based pebbles were found to be more suitable for making choppers and the round-based pebbles for making chopping tools. This mode of selection though found in all the industries of the four regions, it is prominently seen in the Potwar and the North. Chopping tools made on flat-based pebbles are only occassional occurrence, and reveal an interesting technological character *viz.*, the bifacial flaking is done in accordance with the morphology of the raw material. In pointing illustration, the flat surface is flaked at low angle while the flaking of the round surface is done usually at medium to high angles. The typical alternate working on chopping tools is seen invariably on round-based pebbles.

Unassociation of specialized forms of implement (only a limited number of crude scrapers are found in the tool-kits) and a large variety of edge forms and butt forms, would suggest, that chopper and chopping classes perhaps could meet most of the functional needs of their users.

In earlier stages chopper-chopping tradition had a nominal proportion of flake-core element. Most of the flakes seem to be by-products, and also a group of cores may not be cores. They are identified so because they lack the definite mode of working of a recognized pebble tool class. In the later collections of the Potwar region and also the stray finds of the Central India and the Deccan, chopper-chopping tool-kits are marked by advanced technological attachment. It may be noted, that some of the best examples of the discoidal cores and Levallois flake-cores belong to these tool-kits. Besides, emergence of blade detaching technology in these collections is also noteworthy.

If the techno-typological features and the distribution pattern are to be taken to ascertain the chronology, the finds of the Central and the Southern parts of the sub-continent would occupy a later place than the assemblages of the North-west and the North, in the respective order.

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4

Chopper-Chopping and the Acheulians

The distribution of the Acheulian sites of the Indo-Pakistan sub-continent forms just the reverse pattern than was observed in the case of the exclusively chopper-chopping sites (Fig. 6). The north-western part of the sub-continent, the Potwar region, which had profusion of such locales, is now comparatively barren. As only a couple of sites are reported of the Acheulian culture tradition from this area. Contrary to this, the area south of the Gangetic devide has a remarkable density of the Acheulian sites. Chopper-chopping locales of the earlier group are scarce here. That the Acheulians in most of the cases are associated with the chopper-chopping element is apparent from our earlier studies of the important collections of the Indian sub-continent (Jayaswal. 1978 ; 1978 a). Thus, the chopper-chopping in Acheulian tool-kits has a much wider distribution, than the ones which are devoid of Acheulian element. For this reason it becomes essential to examine the nature of the chopper-chopping associating the Acheulians for a proper understanding.

The treatment given to the data in this chapter is slightly different than was adopted in the earlier chapter. The major categorization of the sites within the four regions *viz.*, the Potwar; the Northern India; the Central India, and the Deccan, however remains unchanged. The account of the archaeological data of the first two regions briefs the discoveries which is in accordance with the pattern adopted earlier. But, this pattern had to be altered for the remaining two regions. Due to the concentration of the numerous data from the Central India and the Deccan, it was necessary to be selective. This was particularly needed to avoid the monotonous description and cataloguing of the Acheulian industries. Thus, the account of the two regions commences with the nature of the important tool-kits and the position of the chopper-chopping trait in them. Thereafter, the typo-technological details of the choppers and the chopping tools of a few select industries are given as case study of

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the element under study. These are intended to form the representative features of the chopper-chopping accompaning the Acheulian industries. In the group of available collections only those industries were found suitable, which came from stratified deposits or contained a good number of artefacts and were claimed to belong to a single culture by the investigators. Typological details of the chopper-chopping of each of the select industries, succeed a brief account on their location, stratigraphy and general techno-typological features.

I

THE POTWAR REGION

The Acheulians were inhabiting the Potwar region between the second interglacial and the third glacial periods. This is known from the geo-chronology and the archaeological material discovered by the Yale Cambridge Expedition (De Terra & Paterson. 1939 : 308). Paterson and Drummond mentioned four sites which have yielded Acheulian tools, but, only at one of these it is associated with the chopper-chopping. The exclusively Acheulian locales are Balawal, Chaksighu and Grand Trunk Road (Paterson & Drummond. 1962), while the only claim for the Acheulian with chopper-chopping is made at Morgah. Chauntra does not get mention in the report of Paterson and Drummond, but, is described in the earlier report (De Terra & Paterson. 1939 : 310) and Gzaziosi's subsequent publication (Gzaziosi. 1964).

SITES

Chauntra (72° 58′ E & 33° 21′ N).—The right bank of the river Soan near Rawalpindi was implementiferous.

Morgah (73° 05′ E & 33° 32′ N) —Artefacts were collected from the cemented Conglomerate and surface of the 100' high terrace on the Soan, near Rawalpindi.

STRATIGRAPHY

On the basis of the association with the gravel deposit of the third interglacial, Chauntra assemblage is dated to the third glacial period (De Terra & Paterson. 1939 : 308). Similarly, the assemblage from Morgah is dated to the third glaciation and or the succeeding interglaciation (Paterson & Drummond. 1962 : 100-101).

TYPOLOGY

The tool-kit from Chauntra is not described in detail, but is said to be, ... "a mixture of Acheulian and Soanian elements" (De Terra & Paterson. 1939 : 310). On the basis of the state of preservation the artefacts are divided into three phases, which follow an evolutionary trend from Abbevillian to the Late Acheulian. Details of the chopper-chopping is not given by the investigators, but, an indirect reference to the Late Soan nature of the tool-kit is made. For they state that, "These hand axes are associated with rough discoidal cores and small fine cores of type (iii) of the Late Soan" (De Terra & Paterson. 1939 : 310).

Without having the exact proportions of the tool types of the three phases, it is hard to agree with the evolutionary stages, which are based on a feeble ground *i.e.*, the state of preservation of the artefacts.

Though all the categories of the toot-kit from Morgah is not described, yet details of the chopper-chopping group is available in the second record (Paterson & Drummond. 1962 : 100—101).

The Soan group of artefacts in this assemblage is referred to be crude and akin to the Upper Soan A, and not to it's contemporary facies, the Upper Soan B. For instance, the terminal flat-based and the pointed oblate nucleate (Soan types 1 & 5), are absent, but all the other types are present in the following proportions.

Chopper-chopping types	Soan types	%
Lateral chopper	Flat-base Type 2	15
Scraper on split pebble	Flat-base Type 3	35
Chopper with straight/ Convex edge	Oblate Type 4	10
Lateral chopping/core	Nucleate Type 6	10
Chopping peripheral	Nucleate Type 7	25
Uniface, oval	Nucleate Type 8	5

The exact ratio of the Acheulian element and the chopper-chopping is not mentioned by Paterson and Drummond. Gzaziosi's account, however, specifies the proportion of the handaxe-cleaver and the chopper-chopping as 6 : 1 (Gzaziosi. 1964). The ratio of these two elements would correspond with the frequencies of these in most of the Acheulian industries of the Peninsula.

The variation between the chopper-chopping of the Upper Soan A and the present assemblage is in the form of the percentage fluctuations. Most dominant types of this assemblage *viz.*, Soan type 3, is not so frequent in the other. Similarly, Soan type 1, is conspecious by its absence in the Morgah, while the type is present in the

Upper Soan A. But, Soan type 8 though is present in the later, it is unrepresented in former.

II

THE NORTHERN INDIA

The evidence for the typological trend under study, is almost unrepresented in the sub-Himalayan region of the northern India. There is, however, only one claim from Kashmir where one handaxe was recovered by Sankalia. It was obtained from the junction of the Boulder conglomerate and the brown silt of the Liddar Valley, near Pahalgaon (Sankalia, 1974 : 34-38). Though no definite clues for the association of the chopper-chopping trait were obtained from this locality, the find is siginificant. For, it provides evidence for the existence of biface tradition in the area, which was so for known to have yielded only Soanian tool tradition.

III

THE CENTRAL INDIA

Located between the Gangetic plains and the Deccan plateau, the palaeolithic stations of the Central India are confined only in the west, east and the centre. As the northern part which is, composed of the Ganga-Yamuna doab, is devoid of the Pleistocene remains. The land-mass under study has a number of geo-morphological units, a few of which have been thoroughly investigated by the prehistorians. Noteworthy areas in this context are parts of Gujarat, Rajasthan, Malwa, Bundelkhand, Damoh, the Singrauli basin, the Belan valley, the Son valley, the Narmada valley, Singhbhum, Orissa, West Bengal and Assam. A brief account of the Acheulian industries having chopper-chopping element occurring in these areas is being given in the beginning. This is followed by a description of the collections selected for detailed study *i.e.*, Bariarpur, Adamgarh, Balia nadi and Durkadi.

1. GUJARAT

The palaeolithic sites in Gujarat and Saurashtra are concentrated in the Karjan, Orsang, Mahi, Sabarmati and the Bhadar valleys. The finds although sporadic in nature suggest a strong chopper-chopping base in the Lower Palaeolithic phase of the region. The river Karjan, a small tributary of the river Narmada drains the upper part of the southern Gujarat. The vicinity of Ramgadh village has yielded a small collection of trap and quartzite artefacts (Sankalia. 1946 : 317). The handaxes, according to the investigator, are characterized by the Late Acheulian technology. Along with the Acheulian tools, choppers and chopping tools were obtained. Another tributary of the river Narmada, the Orsang was properly investigated by the First

Gujarat Expedition of 1941 (Sankalia. 1946). Noteworthy Pleistocene sequence and a group of thirty-seven artefacts were noticed at Bahadurpur. The main components of this tool-kit were handaxes (16), choppers (6), discoids and flakes. Artefacts were worked out of quartzite, quartz and trap pebbles.

The important discoveries of the northern and the central Gujarat came from the Mahi and the Sabarmati banks. The area lying between Vasad and Jalampur was investigated by the First Gujarat Expedition. The Pleistocene finds of the Mahi basin here are said to correspond with the Sabarmati basin (Sankalia. 1946 : 1). In the middle course of the Sabarmati basin, the Sabarmati stage lying between the pre and the proto Sabarmati stages has yielded Lower Palaeolithic artefacts (Sankalia. 1946 : 40-43). The boulder conglomerate, and the overlying silt around Hadol (72°51′ N & 23°57′ E) and Pedhamli (72°52′ N & 23°41′ E) contained handaxe-cleaver and chopper-chopping implements. The chopper-chopping element is well represented in these deposits *e.g.*, 25% of the total in the junction of silt and the conglomerate, and conglomerate at Hadol, and 27.5% and 33.7% in the conglomerate and silt deposits at Pedhamli (Sankalia. 1946 : 19-38). At both these places Acheulian element is at times slightly more prominent and is a little lesser than the chopper and chopping element. Sankalia has claimed both Abbevillian and Acheulian traditions in this area (Sankalia. 1946 : 132).

The recent survey of the Bhadar valley in Saurashtra by Lele has brought to light three Lower Palaeolithic localities *i.e.*, Jasdan, Atkot and Dharangadhra. The total collection from this area is very small (Lele. 1972 : 102-104). Chopping tool was obtained from one of the sites, Dharangadhra, which has also revealed two handaxes. The single chopping tool is worked on a flat sub-angular quartzite block. The working edge is zig-zag and occupies the larger axis of the specimen. The handaxes are flaked in the Middle Acheulian tradition.

The association of chopper and chopping tools with the Acheulian lithic tradition is, thus, well established in Gujarat and Saurashtra. But, due to the exploratory nature of the investigations it is difficult to comment on the details of their interrelationship.

2. SOUTHERN RAJASTHAN

Misra's investigations of the southern Rajasthan suggest, that the Pleistocene remains had a concentration in the Chambal system (Misra. 1967). The Banas, an important tributary of the Chambal, alongwith its tributaries *i.e.*, the Berach, the Wagan, the Gambhiri and the Kadmali are noteworthy for the occurrence of the Lower Palaeolithic finds. The ancient deposits as revealed from the schematic section is composed of four layers *e.g.*, the mottled clay, the boulder conglomerate or the gravel I, the silt and the finer gravel II. Acheulian implements and the chopper-chopping tools were obtained from the gravel I (Misra. 1967). We could not examine the collection, but

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it is possible to work out some details of the chopper-chopping element from Misra's report. The same is discussed below.

BEARCH INDUSTRY

Only a total of 161 artefacts was discovered from nine different localities of the Berach basin (Misra. 1967 : 24). The chopper-chopping yielding localities are only five which have a total collection of 150 artefacts. This tool-kit comprises 37.26% of the Acheulian implements and 14.90% of the chopper-chopping tools. Out of the total group of twenty-four specimens, there are eleven each choppers and chopping tools and two 'end core chopper/scrapers' (Misra. 1967 : 24). The investigator notes that the choppers are usually made on flat-based pebbles, while the chopping tools were fashioned out of the rounded pebbles. The latter have either weavy or straight edge. Most of the choppers are laterally worked. A very useful data in the form of breadth-length and thickness-breadth ratios of the tools made on pebbles is provided by Misra, who on the basis of this data infers, that the group under discussion comprises, short, broad and thick specimens in general. However, two specimens illustrated by the investigator (Misra. 1967 : fig, 6-9, 10) are just cores, which are though described as cores, are presumed to be used as chopper-chopping tools at a later stage (Misra. 1967: 26).

WAGAN INDUSTRY

A tributary of the river Berach, the Wagan has also yielded Acheulian tool-kit. A total number of 118 artefacts were obtained from four different localities. The chopper-chopping element accompanys only two of the collections *i.e.*, Hajiakheri and Bhutia. The general typological features of the collection corresponds with the Berach group of industry. For, handaxes and cleavers together form about forty percent of the Wagan collection, while the chopper-chopping element is only 9.32%. The latter types are made on thin pebbles of elongated, oval and round shapes. In no case rounded pebble is utilized. In the group of eleven specimens four are choppers and seven chopping tools. Edges of four chopping tools are lateral and three are on the proximal side, but, three choppers have edges at two ends (Misra. 1967 : 9-12, 50).

CHITORGARH INDUSTRY

In the basin of the river Gambhiri, the most fertile locality of the Lower Palaeolithic facies is the Chitorgarh and its vicinity. From here 242 artefacts were recovered by Misra. Acheulian element in this too, forms 40 % of the collection, whereas, the chopper-chopping tools are present in 9 %. Levallois flakes, blades, discoidal core and tortoise cores show the advance technological attainment of the Chitorians. The twenty-two chopper-chopping tools include nine choppers made on flat-based pebbles, and thirteen chopping tools made out of round based pebbles. No inverse chopper was noticed in this group of artefacts.

NIMBERA ASSEMBLAGE

The Kadmali lithic tradition of the Lower Palaeolithic phase is represented by only a group of thirty-eight specimens which were obtained from Nimbera. Gravel I contained this group of tools. Handaxe-cleaver element dominates the collection (42.11 % of the total), while chopper-chopping element forms 31.58%. Choppers are two and chopping tools ten. The working on these are neat and careful. Both the choppers have straight edges, while in the chopping tools besides straight, convex and pointed edges are also frequent. The typical alternate bold working on chopping tools is not specifically mentioned.

The chopper-chopping element of Rajputana in general are neatly produced, for which medium sized pebbles are utilized. There seems to be cautious selection of pebbles for making of the two classes. For instance, flat-based were preferred for making choppers and round-based pebbles for chopping tools. The common edge form to both the classes are straight and convex.

3. THE MALWA PLATEAU

Sporadic discoveries were made in the Malwa Plateau prior to Khatri's examination of the area in late fifties (Khatri. 1957). Banks of the river Sivana, a tributary of the river Chambal, lying within the administrative boundaries of Mandsor district were found to be implementiferous. The Lower Palaeolithic implements were obtained from Bhangarh, Bilesari, Nanakanthur, Chikalia, Nabharangarh and Mandsor. These collections are assigned to the gravel I of the area.

Mandsor assemblage can be taken to be the representative of the area, as it is the single largest collection of the area and was also examined by the present author.*

In the total of 120 finished tools, there was only two chopping tools (1.6 % of the finished tools) and 38 handaxes and 48 cleavers (together forming 71.8 %). The Acheulian working on these is of developed form and also the flaking off the chopping tools is very neat. The advanced technological attainment of the assemblage is further marked by the presence of the Mousterian and the Levallois cores and flakes.

* The author had an opportunity to study the collection in the Deccan College, Poona, by the kind courtesy of Prof. H.D. Sankalia. But, only a part of the collection was available, for Dr. A.P. Khatri has reported a total of 341 artefacts from the site, while only 204 of these were available to her.

The other collection examined by the present author came from the junction of the Chambal and the Sonita nala. This tool-kit though having all the above mentioned techno-typological features is devoid of chopper-chopping element. It may, thus be surmised that the Acheulian facies of the Malwa plateau was considerably developed, and showed mere absence of chopper-chopping tradition.

4. THE BUNDELKHAND

Taking clues from Khatri's investigations in Malwa, parts of the Bundelkhand region was investigated by Rameshwar Singh (*IAR 1955-56*: 68: 1956-57 : 5, 8, 11). The Upper course of the river Betwa was promising area from the point of view of the early palaeolithic finds. Lalitpur was the most significant discovery of Singh (*IAR 1959-60* : 26; 1960-61 : 37; 1961-62 : 57). Joshi subsequently re-examined the area (*IAR 1963-64* : 49-51). Investigators described the vicinity of Lalitpur as an open-air factory station of the Acheulian man.*

Artefact of the Lalitpur industry are made of fine grained pink Bundelkhand quartzite. The tool-kit is dominated by the classical Acheulian forms, which account for 76% of the finished tools. Cleavers preponderate the finished tools a feature rare in the Indian palaeolithic phase (Jayaswal. 1978 : 122-135). Though there is dearth of pebbles in the area, chopper and chopping tools, were still being made and chunks rather than pebbles were utilized for making the same (6.6 % of finished tools). The other noteworthy character of the industry is the high proportion of the Levallois element.

It may be recalled that the upper and the lower courses of the river Betwa reavealed two different lithic traditions. The one is dominated by the Acheulian traditions, which is evident from the Lalitpur group of sites, and the other is represented by the Lahchura group. The latter is believed to belong to a true chopper-chopping tradition. The stratigraphy of the two do not provide any definite clues for the chronology of the two traditions. Moreover, when the two are placed on the distribution map, it seems that the Lalitpur group is an off-shoot of the Rajputana and the Malwa group, whereas the Lahchura falls within the pocket formed by the Ken basin sites.

5. THE DAMOH AREA

Investigations in the Damoh area and the neighbouring Sagar district by Joshi, has brought to light Ghora, Harat, Khajakheri and Mariado sites which are situated on the river Ken (*IAR 1957-58* : 26). They have yielded twenty-four artefacts *in situ* from the lower gravel. The other seventysix artefacts were obtained from the surface of Rehli, Ghora, Harat, Aslana, Mariodo and Narsinghgarh. Acheulian group forms 32.6% of the collection (Joshi. 1961 : 12). Cores and core-choppers have been categorized together by the investigator. This group comprises fifty specimens, which also include discoidal and irregular cores. Choppers are said to have been made on oval or flattish discoidal pebbles, with steep working on the edge. Chopping tools were made on either small discoidal pebbles or small rectangular pabbles (Joshi. 1961 : 19-20). In the group of twenty flakes, some seem to resemble the by-products of the chopper-chopping.

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* The collections made by Dr. R. Singh and Prof. R.V. Joshi were examined by me at the Deccan College, Pune and the Prehistory Branch of the Archaeological Survey of India, Nagpur, by the kind Courtesy of the respective authorities.

On typo-technological consideration, this lithic tradition shows a closeness to the Banda group of the Ken basin. Bariarpur which can be called a representative industry of the area has been discussed a little later.

6. THE BELAN VALLEY

The lowest implementiferous deposit of the huge Pleistocene and the Holocene schematic sequence of the Belan and the Seoti valleys has revealed Acheulian and chopper-chopping tools (*IAR 1962-63* : 31-32). Lying within the administrative boundaries of Allahabad and Mirzapur districts, the Belan system is studied by the teams of the Allahabad and Banaras Universities. The tools obtained *in situ* from the gravel composed of big angular blocks showed four major categories of finished tools *viz.*, chopping tool (7.4%), handaxe (48.2 %), cleaver (33.3 %) and side scraper (11.1%)*. Acheulian element is associated with both advanced flake detaching technique *e.g.*, Levallois, and the less advanced methods *i.e.*, not well prepared flakes.

The factory sites in the vicinity of the Belan river, are located on the hillocks of Chandatari, Ramgarh, Kabra and Drummondganj. They seem to represent a some what similar lithic tradition (*IAR 1969-70* : 35-38). The tool-kit from one of the sites, Chhatar Palia can illustrate this observation successfully. Situated on the northern slope of the Chandatari hill, it lies at a distance of about eight kilometres west and south-west of Deoghat bridge (*IAR 1969-70* : 35-38). Fashioned out of weathered coarse grained quartzite, the Acheulian character of the Chhatar Palia industry is marked by handaxe and cleaver in considerable proportion (33.3%). Chopper and chopping tools also fare well (4.4% and 11.1%, in the respective order). Four out of fourteen members of the chopping tool group are made on thick rounded flakes. This characteristic is based on the nature of the raw material. The big blocks of sandy quartzite were the only source of raw material which had to be split in small parts before making implements. Appearance of chopper-chopping, thus, is particularly noteworthy, for even though the raw material of the region was not very suitable for making of these classes, they were being produced in a satisfactory proportion.

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* The statistics is based on the collection examined by the present author, at the University of Allahabad, by the kind Courtesy of Prof. G.R. Shorma.

7. THE SON VALLEY

The upper course of the river Son, draining parts of Madhya Pradesh, was investigated by a number of archaeologists (*IAR 1957-58* : 25-26; *1961-62* : 8-9, 24 : *1962-63* : 11). Ahmed's intensive survey of the area brought to light thirty-five Lower Palaeolithic tool yielding sites (Ahmed. 1966). Largest collection comprising twenty-five artefacts was availed from Sihawal. The total number of artefacts from this site and also the others, which have yielded chopper-chopping is very small (a total of 45 from 14 sites, chopping tools are 7 and 15, respectively). The Acheulian and chopper-chopping element in this region seem to occupy respectively 31.5% and 14% of the finished tools.*

The collection from the Singrauli basin selected for a detailed study, has been described a little later. Similarly, the Narmada lithic traditions are taken to be represented by two industries *i.e.*, Adamgarh and Durkadi. The stratigraphic account of this area was discussed in the previous chapter and the details of the selected industries has been dealt after a while.

8. BIHAR, BENGAL, ORISSA AND ASSAM

East of Uttar Pradesh and Madhya Pradesh, the distribution of palaeolithic stations decreases considerably. Main reason for this situation is the limited amount of field investigations. Except for certain parts of Orissa, Bihar and West Bengal, the finds are sporadic in nature.

In Bihar the alluvium formation is where ever interrupted, by the Chhotanagpur plateau, those areas seem to retain palaeolithic remains. For instance, Jethian valley in Gaya district has yielded reminiscents of an Acheulian complex. The rubble deposit of the Jamunia *nala* traversing the Chhotanagpur formation was found to be implementiferous (Narain. 1969). Jethian collection comprised twenty-one artefacts, in which there were six handaxes, three cleavers and one each chopper and chopping tools. A somewhat similar tendency can be seen in the finds from the Hazaribagh and Ranchi districts, which are reported by Ghosh (*IAR 1964-65* : 5). Our survey of some parts of the latter district corraborates the earlier findings (Jayaswal. 1978 a).

Singhbhum (21° 58′ —23° 36′ N & 88° —86° 54′ E), is comparatively well examined by Ghosh. Occupying the southern most corner of the Chhotanagpur, it is drained by the Subernrekha and the Koel rivers. In the five areas, except for Jamada all have yielded Acheulian and chopper-chopping elements (Ghosh. 1970 : 22). From the Chaibasa group of sites twenty-six handaxes and four cleavers were obtained, while the group includes only two choppers. Similarly, Sini area has also reavealed very limited number of artefacts *i.e.*, 19 from three localities (Ghosh. 1970 : 15). It may be a mere chance that choppers here surpass the Acheulian fossil tool types (10 : 6 being their proportion ratio). The presentation of chopper-chopping is better in Ghatsila collection (28 handaxe and 123 cleavers, which were discovered at Galudih, Jagannathpur and Gopalpur (Ghosh. 1970 : 14, 17). The proportion of choppers slightly decreases in Chandil collection. The ratio of chopper-chopping to the handaxe-cleaver was found to be 5 : 156. The noteworthy localities of this area are Domgara, Tillah, Jamdih and Samanpur.

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* Observation is based on the collection available at Deccan, College Poona, by the Courtesy of Prof. H.D. Sankalia.

The general feature of the Singhbhum Acheulian tradition according to investigator's account is the presence of a considerably high proportion of Acheulian fossil types of tools (Handaxe-cleaver forming 63.41 %). Choppers are 9.09 % of the total. It may be specified that the investigator doesnot use chopping tool term, and it is very likely that the type is present in the collection. This collection is referred to as the chopper-biface industry, and has been divided within four techno-typological evolutionary stages *viz.*, Abbevillian and Acheulian I, II & III. The Abbellivian was characterized by crude choppers and handaxes, whereas in the succeeding phase, the Acheulian I, choppers become rare but, handaxes are still crude. The later stages are marked by finely worked Acheulian implements including handaxes and cleavers (Ghosh. 1970 : 25). But, as we have seen above all the finds are of sporadic nature thus, the claim for evolutionary stages in the absence of sufficient data is not justified. It may be surmized that Acheulian tradition was in vogue in the area during the Middle Pleistocene wherein chopper-chopping making also persisted.

Out crops of the Chhotanagpur plateau in West Bengal are implementiferous. Palaeolithic sites here are situated in the districts of Midnapore, Bankura, Birbhum, Burdawan and Purulia. The finds in these are scanty, as the investigations are of exploratory nature. Krishnaswami surveyed parts of the Kangasabati and Kumari basins in the districts of Bankura and Purilia (*IAR 1959-60* : 48-50). The Lower Palaeolithic phase is represented by handaxes, cleavers and one chopper. Dasgupta's investigations in Sisunia hills between the years 1963 and 1969 brought to light an important Acheulian habitat (*IAR 1963-64*: 54; *1964-65*: 51; 1965-66 : 55-57 ; 1968-69: 41-42). The investigator has not mentioned or negated the occurrence of chopper and chopping tools. But, the Ajay valley in Burdawan district is reported to have revealed, an assemblage consisting of chopper-chopping tools and typical handaxes (*IAR 1966-67* : 44). The other noteworthy discoveries of the Acheulian and the chopper-chopping elements made by Dasgupta are Kankardara in Kangsavati valley Bankura district and the area lying between Tapovan and Chandravali in Midnapore

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district (*IAR 1968-69* : 41). The chopper-chopping tools of this area are divided into almond pick, side chopper etc., by the investigators.

Investigating parts of Midnapore and Purulia districts, Ghosh reports Gopalpur (*IAR 1963-64* : 62), Bamandiha (*IAR 1964-65* : 48), and a number of localities on the Subernrekha river (*IAR. 1964-65* ; 51 ; 1965-66 : 58-59). The finds seem to be similar to the Singhbhum group (Ghosh. 1966).

Discoveries in Orissa are confined to Mayurbhanj district and the river valleys of the Mahanadi, Brahmani, Baitarni and the Khadke. The investigator of the river valleys categorically negates the association of the element under study, while Acheulian facies is well represented here. "Typical Soanian pebble choppers or chopping tools do not occur in the author's collection" (Mohapatra. 1962 : 61). But, the earlier investigations in Mayurbhanj district by Bose and Sen have demonstrated the existence of the chopper-chopping alongwith a prominent Acheulian trait. For, the excavations around Kuliana has revealed a collection containing 50% handaxe-cleaver and 23% chopper elements. Besides, a good amount of partly prepared flakes and a nominal proportion of Levallois flakes are present (Bose & Sen. 1948 : 118, 127). Similar to Kuliana, are the lithic traditions of Phulbani district of the south-western Orissa, which includes the existence of Acheulian and chopper-chopping elements (Tripathi 1972). This may suggest, that in the north and north-east the chopper-chopping tradition was confined to a small pocket in Kuliana in Mayurbhanj and perhaps the other areas were devoid of the chopper-chopping element. Which was however present in the south-western part, particularly Phulbani district.

Palaeolithic discoveries are of comparatively later date in the state of Assam *i.e.*, since only in 1965 the investigations were initiated by Goswami and Sharma. The area surveyed by them is the Garo hills, which is situated on the south-western corner of Assam (*IAR 1965-66* : 6 : 1966-67 : 3-5 ; 1967-68 : 7-8; 1968-69 : 2-3 ; 1969-70 : 1-2). Noteworthy observation is that the river valleys containing outcrops of dolerite dykes have revealed palaeoliths. The first palaeoliths in the form of chopper, chopping and scraper were obtained from Rongdu, which was located on the north-eastern part of the Garo hills (*IAR 1966-67* : 3-4). The other important localities, discovered in the subsequent years were Chitra Abri, Selbalgiri and Machinagiri. At the first site one chopper was found along with chipped celts (*IAR 1967-68* : 7), while larger flaked tools like handaxe, chopper, disc and pick were discovered at Selbalgiri and Machingiri (*IAR 1969-70* : 2). However, the typo-technological details of these tools are lacking.

DETAIL OF THE SELECT INDUSTRIES

As mentioned earlier, the four collections found suitable for the detailed analyses come from Bariarpur, Singrauli basin, Adamgarh and Durkadi *nala*. Besides representing different areas *viz.*, the Ken valley in Madhya Pradesh, the southern Uttar Pradesh and the Narmada valley in Madhya Pradesh, these also belong to different types of sites. For instance, the Bariarpur industry was obtained from the terrace of the river, while that of Adamgarh from a rock-shelter. In the other case the exposed gravel of Narmada was tool-making spot at Durkadi, and the Singrauli falls in the line of the usual river basin sites of the Central India.

BARIARPUR INDUSTRY

Situated in the Panna district of Madhya Pradesh, Bariarpur has yielded an industry comprising chopper-chopping and Acheulian elements in the respective order of frequency. The main stream of the river Ken in its upper reaches has formed terraces. It is the highest terrace from where Acheulian and chopper-chopping tools were obtained by Soundara Rajan and Joshi (*IAR 1957-1958* : 26). The occurrance of these two together according to the scholars "... had no specific typological relationship with the Early Soan; instead the stages of fabrication represented by them revealed their own story of gradual typological evolution from the unspecialized core to the bifacial handaxe" (*IAR 1957-58* : 26).

The details of this collection, as per the present author's study, reveals some interesting features.* Medium grained quartzite pebbles of average size were utilized for making artefacts, which show a mixed typo-technological character. Though patinated, the collection is devoid of traces of rolling. As we have shown elsewhere, Bariarpur is one of the few collections of this sub-continent wherein Acheulian element appears in a sub-oridinate position in relation to the chopper-chopping (Jayaswal. 1978). The frequency of chopper-chopping in the finished tool group is 61.8%, while the handaxes and cleavers form only 21. 2% of the same. Besides, Acheulian craftmanship on these are not very advanced.

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* The present author could examine the ollection by the kind Courtesy of Prof. R.V. Joshi and Dr. K.D. Banerjee, at the Prehistory Branch of the Archaeological Survey of India, Nagpur.

MAJOR ARTEFACT CLASSES OF THE BARIARPUR INDUSTRY

Artefact types	Nos.	% in finished tools	% in Total
FINISHED TOOL			
1. Chopper	12	12.8	11.1
2. Chopping	46	49.0	42.5
3. Handaxe	15	16.0	13.8
4. Cleaver	5	5.2	4.6
5. Side scraper	7	7.4	6.4
6. Denticulate	6	6.3	5.5
7. Point	3	3.2	2.7
TOTAL of finished tool	94	99.9	86.6
FLAKE	6		5.5
CORE	3		2.4
DIVERSE	6		5.5
Grand Total	108		100.0

In the group of fifteen handaxes there are six specimens which are proto-handaxes. The unifacial working of these specimens has resulted in a pointed end and unworked pebble butt. The neat shallow working on these would put them under Acheulian element. The other five are though bifacially worked these are also pebble butted. The remaining four are thoroughly worked specimens. In comparison to the earlier ones the specimens of this group are elongated *e.g.*, breadth : length ratio of the earlier two is 1 : 1.3 and 1 : 1.4, while the latter is 1 : 1.8. The size-index range of handaxes is 119-81.5 mm. In the group of cleavers there is only one classical specimens, the form of which was determined prior to its detachment from the core. The remaining ones are either unprepared or retain partly flaked surface. Two of the side-scrapers are made on flat pebbles of 86 and 76 mm size. The remaining five are made on big flakes (92.5 mm sized pebble), which are devoid of marks of prepreparation. The retouching on scrapers and denticulation are of a bold type, and the latter is characterized by Clactonian notches.

The technological processes, prevalent in the industry belong either to Levallois flake detaching technique or to partially prepared core, technique as can be seen in the form of cores of both the types. But Levallois flake was not noticed in the collection, and the group of six flakes seems to belong to the by-product category. It may be noted, that a considerable part of the flakes (19 out of the total of 25) was converted into finished implements *i.e.*, cleaver, side-scraper, denticulate and point. Other technological details were described in our earlier publication, thus, need not be repeated here (Jayaswal. 1978).

Chopper & chopping

NATURE OF PEBBLES UTILIZED FOR CHOPPERS AND CHOPPING TOOLS

Nature of pebble	Form of butt			Size-index (in mm)	Thickness : Length
	Round	Staight	Pointed		
CHOPPER					
FLAT-BASED					
Long	2	—	1	100.0-115.0	1:2.0-2.6
Broad	—	3	—	105.0-115.0	1:1.9-2.0
Equal axes	1	1	—	90.0- 91.5	1:2.0-2.1
ROUND-BASED					
Broad	1	1	—	115.0-119.0	1:2.0-2.2
Equal axes	2	—	—	68.5-110.0	1:1.8-2-0
TOTAL of chopper	6	5	—	68.5-119.0	1:1.8-2.6
CHOPPING TOOL					
FLAT-BASED					
Long	—	1	—	67.0	1:1.7
ROUND-BASED					
Broad	—	20	—	58.0-115.0	1:1.3-1.8
Long	16	—	1	70.0-106.5	1:1.3-1.4
Equal axes	6	1	1	70.0- 81.0	1:1.3-1.4
TOTAL of chopping tool	22	22	2	58.0-106.5	1:1.3-1.8
Grand Total	28	27	3	58.0-119.0	1:1.3-2.6

In comparison to the choppers, chopping tools are made on smaller and thicker pebbles. Besides, there is only one chopping tools on flat-base, while this form of pebble was frequently used for making choppers. Pointed butt is very rare in both, and the other two forms are seen in equal proportions in choppers and chopping tools

FREQUENCY OF EDGE FORMS IN CHOPPERS AND CHOPPING TOOLS

Form of edge	Nos.	%
CHOPPER, LATERAL		
Convex edge	3	25.00
Straight edge	2	16.66
Pointed edge	2	16.66
CHOPPER, EDGE AT SHORT AXIS		
Convex edge	2	16.66
Straight edge	1	8.33
CHOPPER WITH EQUAL AXES		
Convex edge	1	8.33
Pointed edge	1	8.33
TOTAL of chopper	12	99.97
CHOPPING TOOL, LATERAL		
Zig-zag edge	20	43.47
CHOPPING EDGE AT SHORT AXIS		
Zig-zag edge	15	32.60
Pointed edge	2	4.34
CHOPPING WITH EQUAL AXES		
Zig-zag edge	4	8.69
Pointed edge	5	10.86
TOTAL of chopping tool	46	99.96
Grand Total	58	

Most frequent edge form of the choppers of the industry is convex, but, the tendency to produce pointed edge is noteworthy. Except for seven chopping tools (11.20%), all the remaining ones are marked by the typical alternate bold working, resulting into the zig-zag form of the edge. The others have pointed edge which is formed by bifacial working of comparatively finer type. The effort to point one end is characteristic of the chopper-chopping of this industry. Such specimens form 17.24% of the total of the elements under study. This tendency is also seen on the retouched flakes, where also three points occur.

The above description of the Bariarpur collection indicates that the typical Acheulian element is not very pronounced, and the chopper-chopping trait is not only well represented, but, it also shows a few typical features. For instance, chopping tools in their typical form dominate the fisnished tools. Provision of a point to chopper and chopping tools is the other noteworthy character of the industry. Besides, there is a good representation of the retouched flakes. Occurrence of denticulates and points is interesting in the scraper-point group, which are not very frequent.

SINGRAULI COLLECTION

Forming the south-western part of the Mirzapur district, the Singrauli basin (24°0'-24°10' N & 82°41'-83°0' E), was drained by the Rihand system, before the valley was submerged under the Rihand reservoir. The Rihand along with its tributaries the Bichi and the Balia *nadi* revealed Pleistocene remains.

Acheulian remains were reported from this area as early as 1888 by Cockburn. Later, it was properly investigated by Krishnaswami in the month of January 1949, and subsequently, in the month of April of the same year by the Pan-Indian Expedition, which was lead by Zeuner (Krishnaswami & Soundara Rajan. 1951 : 41). Overlying the Talchir formation, the schematic section of the Pleistocene sediments is composed of two gravel deposits and two silt layers. The gravels are implementiferous, while the intervening silts are sterile. The areas lying between Kota and Pipari on the Bichi *nala* and Hinauri on the Balia *nadi* have retained noteworthy clues for building the sediment sequence (Krishnaswami & Soundara Rajan. 1951 : 44-45).

The total collection from the Singrauli basin comprises one hundred and ten artefacts, which are made on quartzite and quartz pebbles. The main components of the collection, as referred to by the investigators are chopper, chopping tool, handaxe, flake and core. The mixed nature of the collection is apparent from the Acheulian and chopper-chopping implements, and, the occurrence of Levallois and Clactonian flakes and cores (Krishnaswami & Soundara Rajan. 1951 : 50-52). Chopper-chopping tools occupy a subordinate position (15% of the total) in relation to the typical Acheulian trait (42.7%).

The Singrauli collection was acquired from Bichi and Balia *nalas*. The following details are based on the Balia collection, which was studied by the present author in the Safdarjung Store of the Archaeological Survey of India*.

MAJOR ARTEFACT CLASSES OF THE BALIA COLLECTION

Artefact types	Nos.	%
FINISHED TOOLS		
1. Chopper	2	2.40
2. Chopping	6	7.22
3. Handaxe	35	42.16
4. Cleaver	7	8.43
5. Side-scraper	10	12.04
6. End scraper, atypical	1	1.20
7. Notched flake	2	2.40
8. Denticulated flake	1	1.20
9, Partially retouched flake	2	2.40
10. Retouched blade	2	2.40
11. Scraper on nodule	3	3.61
FLAKE	9	10.84
CORE	3	3.61
TOTAL	83	99.91

Chopper-chopping form 9.62% of the total, where as Acheulian types are 50.59%, in the Balia assemblage. Besides, implements made on flakes is another noteworthy character, which show various types of retouching, including the end scraper type. The handaxes and cleavers are made in fine Acheulian manner and all the seven cleavers are made on flakes detached by Para-Levallois or Victoria West technique. The cores have both Levallois flake-core and unspecialized flake-cores. Similarly, in flakes one third proportion belongs to the Levallois group, but, the others are massive unprepared flakes which according to the investigators are Clactonian flakes. In the absence of the corresponding cores it is difficult to lay stress on their supposed Clactonian identity. Thus, in all probability these could be primary dressing flakes.

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* The collection was made available by the kind Courtesy of the Director General of Archaeology in ndia.

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Chopper & Chopping tools

There are two choppers and six chopping tools (1 : 3 ratio). Both the choppers are made no flat-based and all the chopping tools on round-based pebbles.

NATURE OF PEBBLES UTILIZED FOR CHOPPER AND CHOPPING TOOLS

Nature of pebble	Form of butt			Size-index (in mm)	Thickness : Length
	Round	Straight	Pointed		
CHOPPER					
FLAT-BASED					
Broad	—	2	—	98.0-100.0	1:2.2
CHOPPING TOOL					
ROUND-BASED					
Broad	—	2	—	66.5- 80.5	1:1.3-1.4
Long	2	—	—	93.0- 95.0	1:1.5-2.0
Equal axes	1	—	1	55.0- 57.5	1:2.4
TOTAL	3	4	1	55.0-100.0	1:1.3-2.2

The flat-based specimens are bigger and thinner than the round pebbles. In round pebbles, those with equal axes are the smallest, while others are of medium dimension.

FREQUENCY OF FORM OF EDGE OF THE CHOPPER AND CHOPPING TOOL

Form of edge	Nos.	%
LATERAL CHOPPER		
Pointed edge	1	12.5
PERIPHERAL CHOPPER	1	12.5
LATERAL CHOPPING TOOL		
Convex edge	2	25.0
EDGE AT SHORT AXIS		
Convex edge	2	25.0
CHOPPING TOOL ON ROUND PEBBLE		
Convex edge	2	25.0
TOTAL	8	100.0

Choppers are worked by bold working flaked at medium angle. In convex edged specimens notching tendency is pronounced. Contrary to this chopping tools show comparatively finer flaking, which was done at low to medium angles. This careful working has provided covex edge to the specimens. Chopping tool in its typical alternately worked zig-zagged edge is conspecious by its absence.

The advanced techno-typological features and a very low proportion of the chopper-chopping settlement in Singrauli basin collection, would thus suggest the negative representation of the true Soanian element in this area. At least in this regard the chopper-chopping element shows different characters, than these observed in the North-western and the Northern regions. Thus, it will be difficult to support the investigators viewpoint that both Soanian and Madrasian facies are well represented in this area. In fact the Singrauli collection suggests the existence of a full-fledged Acheulian complex, which is similar to the Deccan Acheulian facies.

ADAMGARH INDUSTRY

Situated in the low lying hillock near Hoshangabad Adamgarh rock-shelter (77° 43′ E & 22° 0′ N), has brought to light the culture debris from Acheulian to the Mesolithic phase.

The site was reported by the Yale-Cambridge Expedition (De Terra & Paterson. 1939: 322-23), but, was intensively excavated and studied by Joshi in the year 1961 (*IAR 1960-61* : 13). The stratigraphy unearthed here comprises of the following deposits. The sterile lateritic layer at the base is covered by an implementiferous layer, which is composed of angular fragments and blocks of the local rock mixed in the red lateritic clay. Acheulian implements were obtained from this deposit. The next layer consists of Middle Palaeolithic tools, and is also a deposit of angular stone fragments. The microlith yielding black cotton soil finally seals the Pleistocene deposits (Joshi. 1964). The excavator has claimed to have noticed a gradual evolution of lithic technology starting from the Early Acheulian stage to the Post Acheulian, in the palaeolithic tradition of the site. Our examination of the same collection, however, does not confirm it (Jayaswal. 1978). It was noticed that the palaeoliths belong to the Acheulian and the Middle Palaeolithic facies, both on the basis of stratigraphy and the typology.

The Acheulian industry of Adamgarh is represented by a group of two hundred and eighty artefacts, but the collection available to us comprised two hundred and sixty-five artefacts only.* The observations and statistics given here are based on the later material.

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* The collection was available to the present author in the Prehistory Branch of the Archaeological Survey of India, Nagpur, by the kind Courtesy of Prof. R.V. Joshi and Dr. K.D. Banerjee.

Medium grained quartzite pebbles and lumps are exploited for making implements at Adamgarh. Quartzite pebbles are preferred in comparison to the other form of raw material.

THE MAJOR ARTEFACT CLASSES OF THE ADAMGARH INDUSTRY

Artefact types	Nos.	% finished tool	% in total
FINISHED TOOLS			
1. Chopper	15	7.0	5.6
2. Chopping	22	10.3	8.30
3. Handaxe	55	25.9	20.75
4. Cleaver	18	8.4	6.79
5. Scraper on pebble	43	20.2	16.22
6. Point on core	1	0.4	0.37
7. Side-scraper	24	11.2	9.05
8. Point	2	0.9	0.75
9. Miscelleneous	32	15.0	12.07
TOTAL of finished tools	212	99.3	79.90
CORE	39		10.94
FLAKE	24		9.05
Grand Total	265		99.89

The typological and technologicol character of the Adamgarh indicate a developed stage of the Acheulian tradition. As it not only contains finely made thin well formed handaxes and cleavers, but, also a good proportion of Levallois element (15 % of the flakes, numbering 90 if we include the finished tools made on flakes). In the group of cores also, 24 % belong to the Levallois type. Other technological details were given in our earlier publication (Jayaswal. 1978), thus, are not repeated here. The noteworthy feature here is, a considerable proportion of flakes which were utilized (76 out of 90) as tools and the lack of by-products in the tool-kit.

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Chopper & Chopping tool

Though lower than the Acheulian element, the chopper-chopping occupies not very insufficient proportion (17.3 % of the finished tools), which would be expected due to the advanced technological and typological nature of the industry.

NATURE OF THE RAW MATERIAL USED FOR CHOPPER AND CHOPPING TOOLS

Nature of pebble	Form of butt			Size-index (in mm)	Thickness : Length
	Round	Straight	Pointed		
CHOPPER					
FLAT-BASED					
Broad	1	8	—	106.0-105.5	1 : 1.5-2.2
Equal axes	1	—	2	65.0- 68.0	1 : 1.5-1.7
IRREGULAR-BASED					
Broad	1	1	1	104.0-107.5	1 : 1.4-1.5
Total of chopper	3	9	3	65.0-107.5	1 : 1.4-2.2
CHOPPING					
ROUND-BASED					
Broad	4	8	4	86.0-123.5	1 : 1.9-3
Equal axes	3	—	3	68.0- 77.5	1 : 1.4-1.6
TOTAL of chopping tool	7	8	7	68.0-123.5	1 : 1.4-3
Grand Total	10	17	10	65.0-123.5	1 : 1.4-3

A definite choice of the raw material for making chopper and chopping tools is apparent from the above table. There is a frequent use of long pebbles, the broad axis of which are invariably used. In not a single example the working edge is confined to the shorter axis. Besides straight butts, which are seen on the larger number of chopper and chopping tools, round and pointed butts are equally distributed in both the categories. The smallest specimens, both in chopper and chopping tools belong to the pebbles with equally long axes *e.g.*, their dimension-index-range is 65.0-77.5 mm, while the other group has 86.0-123.5 mm size-index range. The size mean of the chopper and chopping tool is 105 mm.

DISTRIBUTION OF THE EDGE FORM IN CHOPPER AND CHOPPING TOOLS

Nature of edge	Nos.	%
LATERAL CHOPPER		
Convex edge	12	32.43
CHOPPER WITH EQUAL AXES		
Convex edge	3	8.10
LATERAL CHOPPING		
Zig-zag edge	14	37.83
Pointed edge	2	5.40
CHOPPING WITH EQUAL AXES		
Zig-zag edge	3	8.10
Pointed edge	2	5.40
Straight edge	1	2.70
TOTAL	37	99.96

All the choppers have convex working edge, which is produced invariably by removing shallow small flakes. The neat working on these suggests controlled flaking. While bold working is completely absent in the group of choppers, it is farely well represented on chopping tools (45.93% of the chopper-chopping and 77.27% of the chopping). All the specimens with zig-zag edge are marked by bold alternate flaking. The fine working of the chopper type characterizes the specimens with pointed and straight edge.

Adamgarh industry thus represents the typical Acheulian phase of the Narmada basin and also the Central India.

DURKADI INDUSTRY

Investigator's observations on the location, stratigraphy typology and technology have already been discussed in the earlier section (Chapter III). Here only noteworthy typo-technological features of the industry, as revealed by our examination of the collection are described.* Incidentally it may be mentioned, that only the group of fresh implements and not the rolled ones have been taken into account.

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* The present author had an opportunity to study the collection at Deccan College, Poona, by the kind Courtesy of Dr. Jorge Armand.

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THE MAJOR CATEGORIES OF THE DURKADI INDUSTRY

Artefact type	Nos.	% in finished tool	% in total
FINISHED TOOL			
1. Chopper	34	34.69	11.25
2. Chopping	6	6.12	1.98
3. Handaxe	7	7.14	2.31
4. Cleaver atypical	1	1.02	0.33
5. Side-scraper	46	46.93	15.23
6. Borer atypical	3	3.06	0.99
7. Burin atypical	1	1.02	0.33
TOTAL of finished tools	98	99.98	32.42
FLAKE	131		43.37
CORE	51		16.88
DIVERSE	22		7.28
Grand Total	302		99.96

It is apparent from the above account that Acheulian technology is neither frequent nor is well developed in the Durkadi industry. In the group of handaxes there is one proto-handaxe and the rest are characterized by early Acheulian working. Similarly, the single cleaver also does not come up to the expected standard. In comparison to the advanced Acheulian technology seen in Adamgarh industry, Durkadi lags behinds considerably. Flake implements are very frequent, but they lack the sophistication in retouching prevalent in the Adamgarh tool-kit.

As in the typology, the technology, of obtaining flakes too is also not of an advanced form. Most of the flakes of the collection are by products (60% of the flakes). They are of varying dimensions and irregulary shaped. A number of categories in the by-products were noticed.

On the basis of the nature of the dorsal surface three types were noticed.

(1) Flakes with unprepared/cortexed dorsal, are the result of primary dressing of core or implements. These have big unflaked striking platforms at a low angle to the flake surface *i.e.*, 50°-60°. Not much variation is found between their length and breadth (breadth : length is 1:0.9-1.4). The specimens of this group seems to be the result of chopper-chopping making process, while massive ones were obtained perhaps by block-on-block method. The latter was applied to give rough form to other artefact classes also.

(2) In the flakes having partly dressed dorsal, the striking platforms may or may not retain flaked surface. This is most frequent type of by-product in which specimens have either very small platforms with prominent bulb of percussion or have very broad platforms. The latter invariably are broad flakes and the former mostly have equal length-breadth axes. All these have low angles between the striking platform and the flake surface. The size-index range of this group is 45-65 mm. Our observation indicates that this group is the result of following the primary dressing of the implements.

(3) A small but interesting group of by-products have well dressed dorsal and also flaked striking platform. Some of these are small Levallois like flakes with micro platforms. This group is referred to as 'gleischgerichtete bearbeitung' (Bosinski. 1965 : 7), and have been rightly interpreted as by-products of the Acheulian technology. In Durkadi only five specimens of this group were noticed and it may be emphasized, that the number of typical Acheulian handaxes is very limited in the collection.

In the remaining flakes unprepared, partly prepared and prepared non-Levallois types were seen. These are of a bigger size as compared to the by-products (90-105 mm). There is a possibility, that quite a few of these were also dressing flakes. Since considerable proportion of such flakes were converted into scrapers we intend to group them under intentionally detached flakes. The cores of the industry correspond with the morphology of the flakes.

Chopper & Chopping tools

NATURE OF PEBBLE UTILIZED FOR MAKING CHOPPER AND CHOPPING TOOLS

Nature of pebble	Form of butt			Size-index (in mm)	Thickness : Length
	Round	Straight	Pointed		
CHOPPER					
FLAT-BASED					
Broad	—	8	2	79.5-115.5	1:1.7-2.5
Long	—	2	1	84.0-113.0	1:1.6-2.2
Equal axes	—	—	3	87.5-114.0	1:1.8-2.0

(*contd.*)

Nature of pebble	Form of butt			Size-index (in mm)	Thickness : Length
	Round	Straight	Pointed		
ROUND-BASED					
Long	1	1	—	80.0-117.5	1:1.6-1.7
Broad	—	2	—	90.0-102.5	1:1.5
Equal axes	2	—	1	82.5- 90.0	1:1.4-1.6
SPLIT-BASED					
Broad	—	3	2	70.0-116.0	1:1.9-2.1
Long	1	1	1	81.5-100.0	1:1.8-1.9
Equal axes	1	—	2	65.0-105.5	1:2.1-2.4
Total of chopper	5	17	12	65.0-117.5	1:1.4-2.4
CHOPPING TOOL					
FLAT-BASED					
Broad	2	2	—	70.0- 87.5	1:1.8-2.4
ROUND-BASED					
Equal axes	2	—	—	35.0- 60.0	1:1.7-1.9
Total of chopping	4	2	—	35.0- 87.5	1:1.7-2.4
Grand Total	9	19	12	35.0 117.5	1:1.4 2.4

Durkadians preferred flat-based specimens for making choppers, which they didnot seem to get always. Thus, splitting and flaking of the under surface was done (total of flat-based and split-based reaches 80% of the chopper group). However, round pebbles were also used for making choppers. Most of the choppers are worked at low angle *e.g.*, less than 60°, and about 20% have a range of 60°-70°. In the group of convex edge all the specimens show abrupt working *i.e.*, above 75°. Denticulated and pointed choppers are worked at low angles (55°-65°).

Preference for flat-based pebbles is seen even in the chopping tools, which is not the case in other industries. But, for this class splitting or flaking of the base is not in vogue. Straight butted specimens are very frequent in choppers, while in the chopping tools rounded butt occur more frequently.

DISTRIBUTION OF FORM OF EDGE IN CHOPPERS AND CHOPPING TOOLS

Form of edge	Nos.	%
Chopper		
LETERAL CHOPPER		
Convex edge	7	17.50
Concave edge	2	5.00
Denticulated edge	4	10.00
Pointed edge	2	5.00
Straight edge	2	5.00
EDGE AT SHORT AXES		
Convex edge	3	7.50
Concave edge	2	5.00
Denticulated edge	3	7.50
EQUAL AXES		
Straight edge	2	5.00
Denticulated edge	4	10.00
Convex edge	3	7.50
Chopping tools		
LATERAL CHOPPING		
Concave edge	1	2.50
Zig zag edge	3	7.50
EQUAL AXES		
Convex edge	2	5.00
TOTAL	40	100.00

Denticulated edges fare well in the choppers (32.35%) and also there is good representation of concave edge. The form of edge, thus, show certain unusual characters.

The four industries discussed above have varying proportions of the chopper-chopping element. The frequency range formed by these, *i.e.*, 10% in Singrauli collection and 61% in Bariarpur industry, seems to have a universal validity for the chopper chopping associated with the most of the Acheulian industries of the Central India. There are, however, a couple of exceptions, like Lalitpur and Chhatar Palia industries, which have much lower frequency (around 7%). The reason for exceptionally decreased position at these sites seems to be the scaricity of the suitable raw material for making choppers and chopping tools. The other noteworthy feature is that, the frequency distribution of the chopper-chopping element in this area does not follow any definite pattern, and is at random.

Preference is given to the flat-based raw material, for marking choppers while chopping tools are usually produced from round based pebbles. Most of the pebbles are utilized lengthwise, thus, have broad straight or rounded butts. Convex edge is the most common form in the choppers in all the industries. The typical zig-zag form of edge in chopping tools though freqeunt in Bariarpur, Adamgarh and Durkadi industries, is absent in the Singrauli collection. Pointing of the edge of chopper and chopping tools is a tendency, which was prevalent at Bariarpur, Adamgarh and Singrauli basin, but was not in practice at Durkadi. At latter site it was replaced by the denticulating of the edges of both the chopper and chopping categories.

VI

THE DECCAN

The area lying south of the Narmada basin is the home for the Acheulian sites. Formed during the Pre Cambrian era, and composed of the Archean, Chronockite, Dharwar and Cuddapah series, the outer crust of this land mass is alomst uneffected by erosional and weathering activities. It has a general slope from the south west to the east, which prompts all the important rivers to drain into the Bay of Bengal. The Pleistocene remains of the area are mostly found in the form of the river deposits. Natural cave and rock shelter habitations of the palaeolithic period are comparatively fewer.

To facilitate the description of the numerous palaeolithic data from the Deccan, it is essential to have small regional units. Since the concentration of the finds is primarily in the river valleys, it is convenient to adpot river system basis for the proposed division. The river systems such as the Godavari, the Krishna, the Pennar, the Swarnmukhi, the Kortalayar etc., are important for palaeolithic discoveries. It was felt desirable in some cases to further divide these areas, particularly in the case of the major river valleys. Thus, the Krishna valley for example may be subdivided into upper, middle and lower Krishna valley. In a fewer cases, where a major river system passes several districts, the sub-division is district wise.

1. THE GODAVARI-PRAVARA VALLEY

The river Godavari along with its tributaries the Wainganga and the Pravara is noteworthy for the Lower Palaeolithic remains, which fall within the administrative boundaries of Maharashtra and Andhra Pradesh. In its upper reaches, Gangapur, Nasik and Nevasa-Chirki groups are well studied palaeolithic localities, while the lower course of the system is known for the Wainganga group of assemblages.

Palaeolithic remains were obtained from the hilly tracts and banks of the Godavari and Kas, near Gangapur, which is ten miles south east of Nasik (Sankalia. 1952). The gravels are implementiferous. A small collection of sixty-five artefacts was picked up. These are classified into 'chopper/point', scraper, handaxe, cleaver, etc. Though the available raw material was not suitable for making chopper-chopping tools, yet they were produced in this region by the early man (Sankalia. 1962 : 45). The associated flakes are of a crude variety and were detached by Clactonian technique. According to the investigators, "The Godavari palaeolithic industry may, therefore, be assigned to the Abbevillian handaxe-cleaver complex among the Stone Age cultures of India" (Sankalia. 1952 : 16-17).

Nevasa-Chirki group was discovered in 1954 by Sankalia on the Pravara river, a tributary of the Godavari (Sankalia. 1956). The Lower Palaeolithic tool-kit from the site has typical Acheulian characters. Later, Corvinus exposed a part of the gravel I, at the junction of the Chirki nala with the Pravara, about five kilometres down stream of Nevasa (*IAR. 1966-67*: 22; 1967-68: 31-32). Chirki-Nevasa industry is dominated by flake-tools made on dolorite, which was available in the form of dyke in the area (Corvinus. 1970). Massive flakes had to be detached first from the dykes and then they were converted into various types of finished tools. Nevertheless, small suitable chunks, when available were also utilized for manufacturing various implements including choppers and chopping tools. 83.5% of the finished tools is formed by cleavers and handaxes, and only 6% by the chopper-chopping tools (Jayaswal. 1978: 126-127). The characteristic feature of the industry is a very high proportion of cleavers made on mostly para-Levallois flakes. In the group of flakes and cores, prepared non-Levallois and Levallois types are very frequent. The representation of the chopper-chopping element is, however, poor.

Acheulian remains are reported from the Wainganga basin around Pauni in Maharashtra (Joshi. 1970: 43-46). The group of eleven artefacts had one each chopper and chopping tool, six handaxes and one cleaver. The chopper and the chopping tool are made on small quartzite pebbles. "Technologically all these artefacts appear to be of advanced Acheulian variety" (Joshi. 1970: 44).

2. THE KRISHNA VALLEY

The Krishna system drains a vast area of Mysore, Maharashtra and Andhra states. In its upper reaches the river is joined by its three main tributaries, the Malaprabha, the Bhima and the Tunghbhadra. All the three have revealed remains of the early man. But, the discoveries from these are either sporadic in nature or are not well described. The valley of the river Bhima has not so far reported significant find of the Acheulian facies. The scattered finds of the chopper-chopping from the Mula-Mutha basin, the tributaries draining the vicinity of Pune, has already been incorporated in the preceding chapter.

The group of sites discovered by Seshadri in the Tungbhadra valley were located in Tumkur district (*IAR. 1955-56*: 68). Kibbanhalli, an open-air factory site is noteworthy among these. Situated on the foot of the Banasandra range, it has yielded an Abbevilleo-Acheulian industry. Details of the typo-technological features of this industry are not well documented. It may, however, be presumed that, chopper-chopping was also being produced here. A little away from this area, an exclusively chopper-chopping tool yielding site, Nittur has been reported (Ansari, 1970).

Joshi's investigation of the Malaprabha basin has brought to light twenty-one sites (Joshi. 1955). Largest collection was made from Khyad. Typical Acheulian character of the industry is marked by 78.5% of handaxes and cleavers, which are worked in fine Acheulian manner. Presence of the chopper-chopping element is nominal (3.78% of the total). The group of fifty-one flakes seems to have both by-products and intentionally detached flakes.

The representative site of the Ghataprabha and the main stream of the river Krishna in its upper reaches is Anagawadi, which has been selected for detailed analyses. The lower part of the Krishna system has been investigated in three parts *i.e.*, the Kurnool and the Nalgonda districts and the Nagarjunakonda valley; main features of these areas are summarized below.

A large portion of Kurnool district was surveyed by Isaac and later on by a team of the Archeological Survey of India. Only limited details of the later investigations have been published (*IAR. 1967-68*: 5-6), thus, the observations on the Acheulian remains of the area are based on the collections made by Isaac (Jayaswal. 1978: 35-37).

Isaac's collection comprised five hundred and eighty-one artefacts, which were obtained from a number of localities (Isaac. 1960). Made on medium grained quartzite the tool-kit had 275 finished tools. The Acheulian fossil type of tools occupy 58.10% of the finished tools, while chopper-chopping element is present in 14.50%. In the latter category flat-based pebbles were preferred and a tendency to split pebble in order to attain a flat-base is noticable (6 out of 40 choppers and chopping tools are on split pebbles). Both the Abbevillian and the Acheulian traditions of making handaxes was prevalent. Technological skill for detching flakes is apparent from a good proportion of Levallois and Mousterian flakes and cores.

Situated in the Guntur district of Andhra Pradesh, the valley of Nagarjunakonda (16°31′ N & 79°14′ E) was intensively surveyed before it was submerged by the Nagarjuna Sagar Dam, an irregation reservoir (Banerjee & Joshi. 1975: 19-41). In the year 1955, Soundara Rajan noticed the material remains of the prehistoric man in the valley for the first time (Soundara Rajan. 1958). The three gravels of the area, according to Soundara Rajan, ... "might represent the evolutionary period to the end of the Lower Palaeolithic"... (Soundara Rajan. 1958 : 58). The subsequent investigations revealed that the Lower Palaeolithic tool-bearing deposits consisted of a pebble layer resting on the basal granitic *murum*, and the calcareous tufa which superimposed the brecciated sandstone (Banerjee & Joshi. 1975 : 23-24). Two techno-typological trends seemed to be present in the Early Palaeolithic facies of the valley (Pant and Jayaswal. 1971 : 344-70; Jayaswal. 1978 : 123-125.

Industry I was obtained from the excavation of the pebble deposit on the north-western slope (*IAR. 1959-60* : 5). Made on coarse grained quartzite, it is composed of 321 artefacts. Chopper-chopping element is quite low in the industry (6% of the finished tools). The characteristic tool type of this industry is the group of cleavers made on unprepared flakes. Cleavers form 41.1% and handaxes only 20.7% of the finished tools. Levallois element is nominal. On the basis of the size of the flakes they can be divided into two groups. The massive ones which were either converted into handaxes and cleavers or seemingly detached for making such implements were at least 40-60 mm bigger than the other group of smaller flakes meant for other implements. There is, however, poor representation of cores and by-products.

Industry II was obtained from two other localities. It seems to share the characteristics of the industry noticed by Soundara Rajan at locality A, which is formed by Abbevilleo-Acheulian and chopper-chopping elements (Soundara Rajan. 1958). The four hundred and thirty-nine artefacts of the industry are made on medium grained quartzite pebbles. Acheulian element forms 36.7% of the finished tools. Occurrence of chopper-chopping is negligible (3.2%). Most dominant tool-type is scraper made on pebble (28.4% of the finished tools). Split or naturally flat-based pebbles are worked on one end or side by flaking bigger chips than is required for retouching. But flaking in this case is smaller than the chopper-chopping type or working. Unprepared flakes still are very frequent and Levallois element is nominal.

It is not possible to draw on the basis of stratigraphy any definite conclusions in relation to these two industries of Nagarjunakonda. Under the circumstances techno-typological considerations become the sole criterion to determining their succession. As shown earlier the latter criterion suggests that the Industry I seems to be cruder than the Industry II, and may have preceded the latter.

The parts of the Nalgonda district, which is drained by the main stream of the river Krishna and its tributaries, namely the Dandi, the Muri and the Peddavagu were implementiferous (Rao. 1966). Two hundred and fifty Lower Palaeolithic artefacts from nine localities were analysed by Rao as one industry. The artefacts are made on coarse grained quartzite pebbles (Jayaswal. 1978 : 37). In the group of 140 finished tools chopper-chopping tools fare well (25%), and the proportion of Acheulian element is decreased (34%). The handaxes and cleavers show fine Acheulian workmanship. The collection is also rich in scraper forms. Levallois element is prevalent both in the form of cores and flakes and the Mousterian technique of flaking can be seen in a few cores.

It may be summarized from the above account that, all the Lower Palaeolithic industries of the Krishna basin come from a single stratigraphic horizon, *i.e.*, gravel I or the lower gravel conglomerate. All of them have been worked out of quartzite pebbles. But, on techno-typological grounds three different trends can be noticed.

Firstly, there are industries dominated by handaxes and cleavers. This group consists of Khyad, Mensangi, Anagawadi, Nalgonda and Kurnool industries. Handaxes which dominate the collections are made in fine Acheulian tradition. Chopper-chopping tools, though negligible in number, are present. Except for a few minor variations, this group compares well with that of Kortalayar basin industries, and the other typical Acheulian tool-kits of this sub-continent.

The second group is characterised by crude pebble tools along with advanced flake detaching techniques. This group has only one assemblage which comes from Nittur site.

The third group which comprises of Nagarjunakonda industry I is characterized by cleaver as its most dominant tool-type. It may be tempting to compare it with the typologically similar industry of Chirki-Nevasa, but technologically the cleavers of both the industries differ widely. The chopper-chopping element is in low proportion inspite of the fact that pebbles of various sizes were available to the early man of the valley. In the absence of a clear stratigraphical evidence it will not be proper to assign any chronological order to these three groups.

3. THE PENNAR BASIN

Originating from Chennarayangutta in the Kolaba district of Mysore, the river Pennar falls into the Bay of Bengal. On its way it drains Anantpur, Cuddapah and Nellore districts. No significant discovery has been made so far from the Anantpur district.

In Cuddapah district, banks of the Sagileru a tributary of the river Pennar was found to retain Pleistocene sediments (Reddy. 1968). A total of six hundred and ninty artefacts were collected by Reddy from twenty-seven sites. Vaddamanu is the representative site of the area, since it has revealed the largest collection *i.e.*, 150 artefacts (Jayaswal. 1978 : 30, 95 97). Medium to fine grained quartzite was used for Veddamanu tool-kit. Acheulian element is suboridinated by the chopper-chopping element, for handaxe-cleaver forms 28.6%, while chopper-chopping is 36% of the finished tools. Not all the handaxes show fine Acheulian working. As fifteen handaxes have pebble butt and are comparatively cruder than the five on cores and one on undetermined type of flake. Discoidal bifaces (3%) also show Acheulian working. Besides, side-scrapers on flakes, scrapers on pebble, point and end-scraper are the other components of the finished tools (Jayaswal. 1978 : 95 97). There seems to be an overwhelming preference for unprepared flakes and those which show marks of partial preparation of the dorsal and the striking platform. There are, however, a few prepared-non-Levallois and Levallois flakes.

Manley's collection from Nellore district was examined by the present author earlier (Jayaswal. 1978 : 30-31). No definite stratigraphical horizon could possibly be assigned to this huge collection of 1433 artefacts (Aiyyappan. 1942). The Acheulian trait is very pronounced (65.5%) in the collection and chopper-chopping element is negligible (4.4%). Other noteworthy features are the presence of the Mousterian and blade elements, and a good proportion of Levallois cores and flakes. In every likelihood this collection incorporates more than one lithic tradition, in which advanced Acheulian emerges as the most prominent tradition.

4. THE SWARNAMUKHI VALLEY

An independent flowing river, the Swarnumukhi drains most of the parts of the Chittoor district. Murty discovered cultural remains of all the three palaeolithic phases. In the seven groups of sites Vedullacheruvu was fouud to be suitable for detailed analyses, The Acheulian in this area is well marked and is associated with chopper-chopping element (Jayaswal. 1978 : 29 30).

5. THE ARANIAR VALLEY

Amridhamangalam is the single noteworthy site in the Araniar valley in Tamilnadu. A number of archaeologists have visited the site (Gupta & Dutta. 1961 : 45-54; *IAR. 1963-64* : 18). Our observations is based on the collection made by Krishnaswami (Jayaswal. 1978 : 28-29). Made of fine grained quartzite the collection comprised three hundred and sixty-six finished tools, one hundred and three cores and ninety-six flakes. Acheulian element is very pronounced *i.e.*, 75.3% of the finished tools. Chopper-chopping element also fares well (13.2%). There are also a few retouched blades (1.3%). In flakes and cores there is a good representation of prepared-non-Levallois and Levallois techniques. The industry seems to be characterized by advanced Acheulian features along with considerably high percentage of advanced flake detaching techniques.

6. THE KORTALAYAR VALLEY

A small river draining Tiruvallur and Ponneri taluks of the Chingleput district of Tamilnadu, the Kortalayar has retained four terraces, formed as a result of the climatic fluctuations of the Pleistocene Period. This terrace sequence was first studied by Paterson near the Red Hills (De Terra & Paterson. 1939 : 327). Subsequently, a series of investigations were conducted in the area, noteworthy among them are by Krishnaswami and Banerjee (Krishnaswami. 1938; *IAR. 1961-62* : 25-26; *1963-64* : 17; *1965-66* : 24; 1967-68 : 25). The earliest phase of the area is represented by the Vadamadurai industry, which has been included in the industries selected for detailed analysis. Another important collection from the Attirampakkam site could not been included since it was not available to us for examination. Gudiyam, a rock-shelter site of the region, has three localities. Locality 1 has yielded a post Acheulian group of artefacts (*IAR. 1962-63* : 12). The industry comming from Locality showed advanced Acheulian features, and was completely devoid of the chopper-chopping element (Jayaswal. 1978 : 107-113). But, the element under study was found to occur in industry A of Locality 3. In this case chopper-chopping forms 12.6% of the finished tools. Acheulian element here is about 52%. The industry is devoid of any classical prepared cores. The other industry B of the same locality, is again devoid of the chopper-chopping element. The Acheulian facies is very well preserved in the Kortalayar valley, which in most of the cases is associated with the chopper-chopping element.

DETAILS OF THE SELECT INDUSTRIES

The following description is based on the four industries *i.e.*, Anagawadi, Hunsgi, Vedullacheruvu and Vadamadurai. The Acheulian tradition of the Deccan is represented through these, which lie quite apart from one and the other.

ANAGAWADI INDUSTRY

The upper reaches of the river Krishna, which were extensively explored by Pappu, revealed that the Anagawadi *nala* was the most promising area for the Lower Palaeolithic remains (Pappu. 1974). Situated at a distance of about 13 km from Bagalkot, Anagawadi (75° 40′ E & 16° 15′ N) section is composed of detrital, cemented pebbly gravel and brown silt layers in the respective order from bottom to top. The Lower Palaeolithic tools were obtained from the pebbly gravel both as a result of the excavations and were also noticed in the loose gravel (Pappu. 1974 : 33-34). The total number of artefacts of the earlier phase recovered from the excavations is 213 and from exploration 370, since in every account the two groups are alike. Following the investigator, the present author also had studied them together (Jayaswal. 1978: 114-116). The total collection referred to by Pappu comprised five hundred and eighty-three specimens, which were also studied by us and the following features were noticed.* Anagawadi industry is fashioned out of quartzite (94.51%), chert (2.06%), quartz (2.06%) and sandstone (1.37%) pebbles. Extensive use of pebbles for marking implements is evident from cortexed patches left on a number of finished tools.

MAJOR ARTEFACT CLASSES OF THE ANAGAWADI INDUSTRY

Artefact type	Nos.	% Finished tools	% Total
FINISHED TOOL			
1. Chopper	27	8.70	4.63
2. Chopping tool	64	20.64	10.97
3. Handaxe	104	33.54	17.83
4. Cleaver	49	15.80	8.40
5. Scraper on pebble	35	11.29	6.00
6. Side-scraper on flake	16	5.16	2.74
7. Discoid biface	4	1.29	0.68
8. Miscelleneous	11	3.54	1.88
TOTAL of finished tools	310	99.96	53.13
FLAKE	69		11.83
CORE	128		21.95
DIVERSE	76		13.03
Grand Total	583		99.94

It is apparent from the above account that the typology of the industry under study is marked by typical Acheulian features. The handaxes, cleavers and the discoidal bifaces are finally worked and together form 49.34% of the tool group. The tradition retouching flakes was not very popular, but retouching of pebble was quite in vogue (11.29% of the finised tools).

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* The author is grateful to Dr. R.S. Pappu of the Deccan College, Pune, for giving necessary facilities to examine this collection.

Cores are present in good proportion and show more than one technological process, which is clear from the appearance of the Levallois, discoidal, unprepared and partly prepared cores. Blade element is absent. This picture is supported by the flakes of the industry also. Byproducts are not well represented in the collection. In fact in comparison to the crores and the core-tools, the representation of intentionally detached flakes too is unsatisfactory.

Chopper & Chopping

Chopper-chopping element is quite strong in the industry (39.3% of the finished tools). Medium sized pebbles are used for this category.

NATURE OF PEBBLES UTILISED FOR CHOPPER AND CHOPPING TOOLS

Nature of pebble	Form of butt			Size-index (in mm)	Thickness : Length
	Round	Straight	Pointed		
CHOPPER					
Flat-based					
Long	3	1	4	90.5-102.5	1: 1.8-2.0
Equal axes	8	2	9	77.5-81.5	1: 1.6-2.0
TOTAL of choppers	11	3	13	77.5-102.5	1: 1.6-2.0
CHOPPING TOOL					
FLAT-BASED					
Long	3	—	6	85.5-115.0	1: 1.8-2.0
Broad	—	2	—	82.5- 85.0	1: 1.8
Equal axes	2	—	3	75.0- 80.0	1:1.7-1.9
ROUND-BASED					
Long	3	—	6	77.5- 81.5	1: 1.2-1.7
Broad	1	5	2	85.0- 98.0	1: 1.1-1.6
Equal axes	12	4	15	80.0- 98.0	1: 1.07-1.5
TOTAL of chopping	21	11	32	75.0- 11.5	1: 1.07-2.0
Grand Total	32	14	45	75.0-115.0	1: 1.07-2.0

No significant variation in the size of the chopper-chopping members is found, as most of the specimens have 75 to 85 mm size-index. Besides, roughly circular and elongated pebbles with round or pointed butts govern the morphology of the chopper-chopping categories. The rounded or the short axis of the pebbles are worked. All the choppers are made on flat-based pebbles, while both flat-based and round-based pebbles were utilized for chopping tools. Most of the chopping tools, however, are made on round-based pabbles.

DISTRIBUTION OF FORM OF EDGE IN CHOPPER AND CHOPPING TOOLS

Nature of edge	Nos.	% in each class	% in total
CHOPPER			
Edge at short axis			
Convex edge	5	18.51	5.49
Straight edge	2	7.40	2.19
Pointed edge	1	3.70	1.09
Edge axis equal to butt			
Convex edge	8	29.62	8.79
Straight edge	4	14.81	4.39
Peripheral chopper	7	25.92	7.69
TOTAL of choppers	27	99.96	29.64
CHOPPING TOTAL			
Lateral chopping tool			
Zig-zag edge	6	9.37	6.59
Convex edge	4	6.25	14.81
Edge at short axis			
Zig-zag edge	8	12.50	8.79
Convex edge	7	10.93	7.69
Pointed edge	3	4.68	3.29
Edge axis equal to butt			
Zig-zag edge	16	25.00	17.58
Convex edge	6	9.37	6.59
Notched edge	5	7.81	5.49
Peripheral chopping	9	14.06	9.89
TOTAL of chopping tools	64	99.97	80.72

Convex and straight edges in the choppers by neat working, at times show more than one series of flaking. The single pointed chopper has a small point due to careful working. The angle of flaking on the choppers is low *i.e.*, 60°-65°. The bold working is absent on the choppers. But the type is in vogue on chopping tools as the deep but small flake-scars detached alternately have provided zig-zag edge to most of the specimens. The convex edge is the result of careful working seen in the form of small shallow scars. Notched edge on chopper and peripheral chopping tools are the other note-worthy forms.

The chopper-chopping element of the industry shows a number of typo-technological forms.

HUNSGI INDUSTRY

Situated in the south-western part of the Shorapur talk of the Gulbarga district of the Karnatak State, Hunsgi Valley (16°27′ N & 76° 31′ E) is brought to light by Paddayya. (Paddayya. 1977). Composed of granite, shale limestone and the Deccan trap, the valley retains debris of the Acheulian inhabitants in some what undisturbed condition. The tool-kit obtained from the Acheulian occupational floor in the year 1975, by Paddayya, comprised two-hundred and ninety-one artefacts. Chopper-chopping of the collection was studied by the present author, and the details mentioned for this class depends on our own observations.* But the general typo-technological features of the industry described below is based on the account of the investigator (Paddayya. 1977).

The raw material utilized by the Acheulian man of Hunsgi is limestone, which is found mostly in the form of chumks in the valley. The finished tools in the industry, as per the investigator are 109 and are separable within the following categories (Paddayya 1977 : 353-54).

SHAPED TOOLS	Nos.	%
Cleavers	28	25.68
Handaxes	18	16.51
Knives	14	12.84
Choppers	9	8.25

(Contd.)

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* The chopper-chopping component of the industry was examined by me at Deccan College, Pune, by the kind Courtesy of Dr. K. Paddayya.

SHAPED TOOLS	Nos.	%
Picks	8	7.33
Poly hedrons	10	9.17
Spheroids	4	3.66
Scrapers	15	13.76
Flakes with prepared butt	2	1.83
Backed tool	1	0.91
TOTAL	109	99.94

The pronounced Acheulian character of the industry is clear from the above, wherein chopper-chopping group, which is referred to as 'choppers' is in subdued position.

Chopper & Chopping

Chopper and chopping tools are made on limestone nodules or chunks, which are heavily patinated.

NATURE OF PEBBLES UTILIZED FOR CHOPPER AND CHOPPING TOOLS

Form of raw material	Form of butt			Size index (in mm)	Thickness : Length
	Round	Straight	Pointed		
CHOPPER					
Flat-based Long	—	—	1	85.0	1 : 1.9
Split-based, Long	—	—	2	77.5-95.0	1 : 1.8-2.3
Round-based, Broad	—	1	—	95.5	1 : 2.0
TOTAL of chopper	—	1	3	77.5-95.5	1 : 1.8-2.3

(Contd.)

Form of raw material	Form of butt Round	Straight	Pointed	Size index (in mm)	Thickness : Length
CHOPPING TOOL					
Flat-based, Broad	—	1	—	77.5	1 : 1.5
Both surfaces flat, Broad	—	2	—	78.5-116.0	1 : 1.5-1.7
Round-based, Broad	—	1	—	90.0	1 : 1.5
CHOPPING/SCRAPER					
Round-based, Broad	—	1	—	112.0	1 : 2.6
TOTAL of chopping tool	—	5	—	77.5-116.0	1 : 1.5-2.6
Grand Total	—	6	3	77.5-116.0	1 : 1.5-2.6

Nodules in their original form were not very suitable for making choppers and thus were split to acquire one flat surface. However, there were some flat-based chunks and those with dorsal and ventral flat surfaces, were preferred both for fashioning chopper and chopping tools. The other noteworthy feature is that the round butt is completely absent and in the group of pointed ends, the butt is not smooth but undulating. Except for the two bigger specimens *i.e.*, the chopping/scraper and one of the chopping with both the surfaces flat, rest of the specimens have size-index range of 77.5-95.5 mm.

DISTRIBUTION OF FORM OF EDGE IN THE CHOPPER AND CHOPPING TOOLS OF HUNSGI

Form of edge	Nos.	%
CHOPPER		
Lateral, Convex edge	1	11.11
Edge at short axis		
Convex edge	1	11.11
Straight edge	1	11.11

(Contd.)

Form of edge	Nos.	%
CHOPPING TOOL		
Lateral		
Straight edge	1	11.11
Zig zag edge	1	11.11
Convex edge	1	11.11
Edge at short axis, pointed	1	11.11
Peripheral chopping	1	11.11
CHOPPING/SCRAPER, straight edge	1	11.11
Grand Total	9	99.99

It is evident from the above account, that no single specimen of a class tallies with the other. This would suggest non standarization of the sub-classes of the chopper and chopping tools. It may be emphasized that these categories do not show the classical types. The bold flaking on them is rare. Only one chopping tool with zig zag edge indicates bold working, while most of the specimens show flake-scars, which are big and shallow. Except for one chopping tool which has lower working angle *i.e.*, 60°—65°, all the others are worked at medium angle *i.e.*, 70°-80°. Contrary to chopping tools all the choppers are worked at high *i.e.*, 85°-87°.

The low proportion of the chopper and chopping tools at Hunsgi, and atypical typology of these, seems to be the result of the form of the raw material which was not suitable for this category, and was perhaps unrelated to a particular techno-typological trend. This is because quite a few Acheulian industries of the Deccan have considerable proportion of the chopper-chopping element.

VEDULLACHERUVU INDUSTRY

The river Swarnamukhi draining the parts of the Chittoor district in Andhra Pradesh, has revealed important palaeolithic remains. The general schematic section observed by Murty who has conducted explorations and excavations in the area, is as follows. Above the bed-rock lies the graval I. This deposit has revealed the Lower Palaeolithic tool-kit. It is overlain by a sterile silt deposit, which is covered by a stratum of finer gravel. Middle Palaeolithic artefacts were obtained from it, while the Upper Palaeolithic group was obtained from the eroded surface of the first aggradational terrace (Murty. 1966 : 170). We have found Vedullacheruvu industry suitable for detailed analysis.*

Coarse to medium grained quartzite pebbles were utilized for making implements by the Lower Palaeolithic man of the area, remains of which were available in the form of 281 artefacts, (Jayaswal. 1978 : 29-30).

MAJOR ARTEFACTS CLASSES OF VEDULLACHERUVU INDUSTRY

Artefact types	Nos.	% in finished tools	% in total
FINISHED TOOL			
1. Chopper	11	5.72	3.91
2. Chopping tool	19	9.89	6.76
3. Handaxe	55	28.64	19.57
4. Cleaver	12	6.25	4.27
5. Scraper on pebble	31	16.14	11.03
6. Discoidal biface	2	0.96	0.71
7. Side-scrapper	43	22.39	15.30
8. End-scrapper	1	0.52	0.35
9. Blade with marginal retouch	3	1.56	1.06
10. Miscelleneous	15	7.81	5.33
TOTAL of finished tool	192	99.88	68.29
CORE	16		5.69
FLAKE	73		25.97
Grand Total	281		99.95

It is primarily a core industry. Acheulian workmanship is seen on the handaxes cleavers and discoidal bifaces, together they form 35.85% of the finished tools. A little less than half of the flakes (40% of the total number of flakes) were retouched and converted into scrapers. Besides, a considerable proportion of flakes seems to be intentionally detached, since only 11.66% could be determined as by-products. The by-products of the tool-making process are usually small *i.e.*, 40 mm dimension-mean, while the primary dressing flakes are comparatively bigger (60-70 mm index-range). One third of the by-products are the result of handaxe making. All these have angle-range of 70°-80°. Prepared-non-Levallois flakes dominate and there are also a few Levallois flakes (6.6%) and blades (5%). The core types in general correspond with the flake types of the industry.

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* It was possible for me to examine the collection in the Deccan College, Pune by the kind Courtesy of Dr. M.L.R. Murty.

Chopper & Chopping

Choppers and chopping tools of the industry form 15.50% of the finished tools and do not fall on the lines of the Potwar or the Durkadian chopper-chopping morphology. It may be mentioned, that a good number of pebbles were broken, but were left incomplete or could not attain classical forms. This group is smaller than the choppers and choppings of the industry (average size-index being 55 to 60 mm). A considerable proportion of these is marked by small neat breaking in series, which is confined to one side or end. Such specimens are grouped under scrapers on pebbbles.

NATURE OF PEBBLES UTILIZED FOR CHOPPER AND CHOPPING TOOLS

Nature of pebble material	Form of butt Round	 Straight	 Pointed	Size-index (in mm)	Thickness : Length
CHOPPER					
Flat-based long					
Broad	2	—	1	80.0-86.0	1 : 2.0-2.6
Equal axes	2	—	—	70.0-73.0	1 : 2.3-2.5
Round-based, Equal axes	1	1	2	60.0-67.0	1 : 1.5-1.7
Split-based, Broad	–	.–	2	102.0-107.0	1 : 2.3-2.6
TOTAL of chopper	5	1	5	60.-0107.0	1 : 1.5-2.6
CHOPPING TOOL					
Round-based					
Broad	1	10	—	90.0-115.4	1 : 1.2-1.9
Equal axes	2	—	—	50.0-65.0	1 : 1.2-1.5
CHOPPING/CORE *Flat-based*	6	—	—	80.0-92.5	1 i 1.9-2.0
TOTAL of chopping tool	9	10	—	50.0-115,0	1 : 1.2-2.0
Grand Total	14	11	5	50.0-115.0	1 : 1.2-2.6

The proportion of chopper-chopping would decrease by 3.12%, if the chopping/core group is not counted in the total. The six specimens are of medium size with flat-bases. The flaking is at very low angle, while the thick dorsal has medium to high angle of working. The flaking on these are of shallow flat type. The remaining chopping tools are made on round pebbles, which are laterally flaked in most of the cases. In the choppers, flat-based and split-based pebbles are preferred to the round-based pebbles.

DISTRIBUTION OF EDGE FORMS IN CHOPPER AND CHOPPING TOOLS OF VEDULLACHERUVU

Nature of edge	Nos.	%
CHOPPER		
Chopper lateral		
Convex edge	1	9.09
Notched edge	2	18.18
Pointed edge	2	18.18
Equal axes		
Convex edge	1	9.09
Single stroked	2	18.18
Notched edge	2	18.18
TOTAL of chopper	11	99.99
CHOPPING TOOL		
Chopping, lateral		
Zig-zag edge	8	42.10
Convex edge	3	15.78
Equal axes		
Convex edge	1	5.26
Zig-zag edge	1	5.26
CHOPPING/CORE		
Convex edge	6	31.57
TOTAL of chopping tool	19	99.57

Notched edge is the characteristic of the choppers (36.36%). These are formed by medium to high angle flaking off small shallow scars detached between 70° and 80° angles. Almost similar mode of flaking is found on convex edged choppers and chopping tools. The characteristic zig-zag edge of the chopping tools is the result of big shallow flakes detached alternately. The edge thus, doesnot have deep curvature as is found in the case of bold working. The working angle range in this 80°-85°. Two different angle-range are found on the specimens of the chopping/core group *e.g.*, these are 50°-56° for the ventral face and 70° and above for the dorsal face.

VADAMADURAI INDUSTRY

Situated on the right bank of the river Kortalayar, it is claimed to be the oldest palaeolithic site of the region, since the artefacts were associated with the terrace TD, the highest terrace of the river Kortalyar. The village Vadamadurai (80°28' N & 13°17' E) is 42 km north-west of Madras and the site is five km north-west of the village. De Terra and Paterson, Krishnaswami and Banerjee have studied the area intensively. Paterson and Krishnaswami classified the artefacts within three techno-typological stages on the basis of the state of preservation (De Terra & Paterson. 1939 ; Krishnaswami. 1947 : 33-34). K.D. Banerjee during excavations of the site observed slightly different chronology (*IAR. 1966-67* : 20-21). The lowest implementiferous boulder and gravel, which rests on the Sriperumbudur shale contained early Acheulian tools in very rolled condition. The group of 73 artefacts acquired from the layer (3) were in very rolled condition, hinding the techno-typological details.* The next two layers, the lateritic gravel and the lateritic clay contained Acheulian implements in mint condition. The tool-kits from both the layers were identical. Our earlier analyses of the two confirms postulation of the investigator, (Jayaswal. 1978 : 103-107). Thus, the artefacts from both the layers are studied together, here.

MAJOR ARTEFACT CLASSES IN VADAMADURAI INDUSTRY

Artefact type	Nos.	% in finished tool	% in total
FINISHED TOOLS			
1. Chopper	13	2.92	1.60
2. Chopping tool	43	9.68	5.30
3. Handaxe	167	37.61	20.61
4. Cleaver	15	3.37	1.85
5. Scraper on pebble	116	26.12	14.32

(Contd.)

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* The material from Vadamaduri was available to me at Prehistory Branch of the Archaeological Surve yof India, Nagpur, by the kind Courtesy of Dr. K. D. Banerjee.

Artefact type	Nos.	% in finished tool	% in total
6. Side-scraper on flake	34	7.65	4.19
7. Denticulated & notched flakes	22	4.95	2.71
8. End-scraper	20	4.50	2.46
9. Miscellencous	14	3.15	1.72
TOTAL of finished tools	444	99.95	54.76
FLAKE	277		34.19
BLADE	23		2.83
CORE	66		8.14
Grand Total	810		99.92

In the finished tools various forms of handaxes and cleavers were noticed (Jayaswal. 1978 a). Together they form 40.98% of the finished tools, while chopper and chopping tools are 12.60%. Both Abbevillian and Acheulian workmanship is found in the industry. The former is found on sub-triangular, sub-cordiform and elongated cordiform handaxes (20% of the handaxes). Rest of the specimens are marked by shallow scars of Middle Acheulian type. Practice of retouching does not seem to be very frequent. Though there are scrapers and even notched flakes, generally speaking the Acheulian element is a dominant feature.

Most of the flakes retain pebble surface and show either no preparation or a little preparation. There is a possibility that a good proportion of these are by-products. Levallois flakes, Levallois points and blades (7.3, 1.5 and 6% of the flake-blade group) mark the technological advancement attained by the Acheulian man of Vadamadurai.

Chopper & Chopping

The chopper-chopping component of this industry forms 12.60 % of the finished tools, wherein proportion of choppers is considerably lower than that of chopping tools *i.e.*, 1 : 3.30.

In the group of cores there were quite a few specimens which looked like chopper chopping tools. The cores with little preparation which is generally confined to the striking platform posed the problem of seperation (40.5 % of the cores). But, a closer examination of these prompted us to classify them within cores and not as chopper-chopping tools. The size-index range of such specimens is 335.5—65 mm. The larger specimens of this type of cores were certainly bigger than the chopper-chopping class but the smaller ones were similar to the latter. The group of crores could be separated from the other category, primarily on the basis of the mode of working on these. For instance, the angle and distribution pattern of the flake-scars on the cores indicated that they were exploited for obtaining suitable flakes and were not chipped off to achieve a working edge.

NATURE OF RAW MATERIAL UTILIZED FOR CHOPPER & CHOPPING TOOLS OF VADAMADURAI

Nature of pebble	Form of butt			Size-index (in mm)	Thickness: Length
	Round	Straight	Pointed		
CHOPPER					
flat-based					
Broad	—	4	1	66.0-124.5	1:1.3-2.6
Long	—	—	1	83.0	1:1.4
Split-based					
Broad	4	4	2	92.0-70.0	1:1.3-2.1
Long	—	—	1	81.5	1:1.4
TOTAL of chopper	—	8	5	66.0-124.5	1:1.3-2.6
CHOPPING TOOL					
flat-based					
Broad	4	11	1	65.0-95.0	1: 1.5-1.7
Split-based					
Broad	3	5	—	70.5-116.0	1: 1.3-1.5
Long	5	1	2	75.0-90.0	1: 1.4-1.8
Round-based					
Broad	1	5	1	81.0-102.5	1: 1.4-1.6
Long	2	—	2	71.5-118.5	1: 1.3-1.5
TOTAL of chopping tool	15	22	6	65.0-118.5	1: 1.3-1.8
Grand Total	15	30	11	65.0-124.5	1: 1.3-2.6

Most of the pebbles utilized for both the categories are flat-based. In choppers, which invariably have flat-based, more than half of the specimens are split or flaked to acquire such a surface. Similar practice prevailed the chopping tools. But, the latter had a considerable amount of round-based pebbles. The other noteworthy feature of both the groups is, that the working edge is confined to the longer axis in most of the cases. It is also noticed that the specimens with equal axes are avoided in these. The round butt in most of the specimens is deep U form.

DISTRIBUTION OF THE FORM OF EDGE IN THE CHOPPER AND CHOPPING TOOLS

Form of edge	Nos.	%
CHOPPER		
Flat-based, Lateral		
Straight edge	1	1.8
Notched edge	2	3.5
Pointed edge	2	3.5
Edge at short axis		
Notched edge	1	1.8
Split-based, Lateral		
Straight edge	3	5.3
Notched edge	3	5.3
Edge at short axis, Notched edge	1	1.8
TOTAL of choppers	13	23.2
CHOPPING TOOL		
Flat-based, edge at short axis		
Convex edge	10	18.0
Zig-zag edge	7	12.4
Split-based, Lateral		
Convex edge	3	5.3
Straight edge	3	5.3
Edge at short axis		
Notched edge	2	3.5

(Contd.)

Form of edge	Nos.	%
Convex edge	2	3.5
Zig-zag edge	4	7.3
Round-based, Lateral		
Zig-zag edge	4	7.3
Edge at short axis		
Straight edge	3	5.3
Zig-zag edge	3	5.3
Pointed edge	2	3.5
TOTAL of chopping tools	43	76.8
Grand Total	56	100.0

The longer axis of most of the pebbles are worked unifacially in such a way that notched edge is produced, which is the most frequent type in chopper (53.84% of the choppers). The other common forms are pointed and straight edges. Both the specimens having narrow working edge have notched edges.

In the chopping tools zig-zag edge preponderates *i.e.*, 46.51%, which is followed by the convex edge, 34.88% and straight edge 13.95%. There are, however, only a couple of examples having notched edges. Those with zig-zag edge have typical bold alternate working, while the others are carefully flaked in one or more than one series.

The comparison of the chopper-chopping components of Vadamadurai which is the southern most site selected for the detailed study, with the Soan group of Potwar, showed that only a few similarities were noticed within the two and these similarities were by and large within the atypical forms and not in the typical forms (Jayaswal. 1978 b).

The typo-technological features of the four selected industries discussed above, roughly covers the entire area of the Acheulian domain in the Deccan. The western part of it is represented by the Anagawadi and Hunsgi industries, the eastern part by the Vedullacheruvu industry and the southern by the Vadamaduri industry. All of these show a strong tendency of Acheulian implement making, but are invariably associated with the chopper-chopping components. The frequency range of the latter is 8.25% to 29.34%, but most of the industries fall within 10 to 15% range. It is interesting to note that the typical form of chopper, with bold flaking becomes scarce in this region, there are, however, quite a few typical chopping tools. Incidentally, the number of chopper decreases now and there is a good proportion of chopping tools. The practice of producing scrapers on pebbles of flat nature is a very common feature. It seems that scrapers on pebbles were perhaps a reformed type and good substitute for the chopper-chopping catergories.

RESUME

To sum up, the features given below are based on the archaeological data from the Central India and the Deccan, as the details of the data from the north-western and the northern part of the sub-continent is not available.

Chopper-chopping tools are found in almost every Acheulian tool-kit. This fact becomes apparent from the above account. But, their frequencies have much variation *i.e.*, 2-61% in finished tools. However, the frequency distribution of this element does not follow any regional pattern. The variation seems to be a typological feature and at times looks to be dependent on the nature of the raw material. For instance, the three frequency groups are formed by the chopper-chopping components of the Acheulian industries of the Central India and the Deccan. The major group is formed by the typical Acheulian industries wherein the element under study has the frequency range of about 10 to 20%. This feature is prevalent in Rajputana, Adamgarh group of industries in the Narmada valley, Son valley and area south of the Krishna river. The other group is formed by a few industries like Lalitpur, Chhatar Palia, Chirki-Nevasa, Nagarjunakonda industry I and Hunsgi. The chopper-chopping element in none of these exceeds 9%. It may be worthwhile to recall that all of these are marked by a very high proportion of cleavers (more than 25% of the finished tools). Except for Nagarjunakonda valley, where pebbles are in abundance, all other sites were characterized by scaricity of suitable raw material in the form of water borne pebbles for making chopper and chopping tools. In the third group the frequency of chopper-chopping element is invariably more than 30% and in exceptional cases it reaches above 60% of the finished tools. The members of this group are scattered over a vast area *i.e.*, Bariarpur in the Ken valley, Mahadeo Piparia and Durkadi in the Narmada valley, Anagawadi in the upper course of the Krishna valley and Vaddamanu in the Pennar valley. Besides, the tendency is well marked in the parts of Gujarat. The Acheulian element here has a comparatively lower frequency and in Bariarpur and Durkadi the chopper-chopping element, takes a precedence over Acheulian.

Sites	Ratio		
	Chopper	:	Chopping
CENTRAL INDIA			
Bariarpur	1	:	3.83
Singrauli	1	:	3.00
Adamgarh	1	:	1.46
Durkadi	5.66	:	1
THE DECCAN			
Anagawadi	1	:	2:37
Hunsgi	1	:	1.25
Vedullacheruvu	1	:	1.72
Vadamadurai	1	:	3.30

Except for Durkadi industry, where choppers are more than chopping tools, bifacial flaking is preferred to the unifacial in all other cases. Numerical ratio of chopper and chopping tools does not reveal any pattern except that in the case of advanced Acheulian industries, the ratio of chopper and chopping tools shows a variation of 1 : 1.25—1.72. The convex and straight edges in the choppers of Acheulian tool-kit suggest careful working of the edges. It was achieved in most cases by detaching more than one series of flakes, a mode closer to the Acheulian way of flaking. But, the typical style of making chopping tools was, however, retained. In a few speciemens of the latter category too, the Acheulian influence of flaking can be seen.

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5

Discussions and Interpretations

Various counts of the technological and typological features of the chopper-chopping element detailed in the preceding chapters are indicative of a number of noteworthy factors. A comparative account, as well as, a synthesis of these are required to derive meaningful conclusions. This is being attempted in the First part of this chapter. In the Second part, an attempt has been made to evaluate in brief the important formulations regarding the chopper-chopping component of the Indian sub-continent, in the light of the deductions arrived at by the present study. The Third part incorporates the interpretation of the morphological features in terms of possible utility and functional need of their users.

I

In almost entire Indo-Pakistan sub-continent which retains remains of the Lower Palaeolithic Period, chopper-chopping tools forming part of the Lower Palaeolithic assemblages are widely scattered. Their occurrence has been reported from both the exclusively chopper-chopping localities and the Acheulian sites as well. Thus, the occurrence of this element has a uniform spatial distribution wherein not a single region is such where complete absence of this element has been recorded.

Contrary to the even occurrence pattern, the frequency range of the chopper-chopping element shows a very wide variation *i.e.*, 2% to 60%, and above. This range seems to form four frequency groups *viz.*, (1) Industries with very low proportion of chopper-chopping element ; (2) Industries with medium frequency range of the chopper-chopping tools ; (3) Industries with high to very high frequency range of chopper-chopping tools : and, (4) Exclusively chopper-chopping tool industries. The wide frequency range of the element under study may be explained by two factors : (i) the availability or otherwise of the suitable form of raw material, and (ii) the presence of a particular techno-typological trend within the Acheulian complex. Besides, it also becomes apparent from our analyses, that except for the last group, which seems to be confined to an area, the frequency distribution does not follow any regional pattern. Elaboration of all the four frequency groups may illustrate some of the noteworthy features of the chopper-chopping component of the Indian Palaeolithic facies.

1. INDUSTRIES WITH VERY LOW PROPORTION OF CHOPPER-CHOPPING TOOLS

The low to very low proportions of the chopper-chopping element in this case was noticed only in a few Acheulian industries, which seem to be having a couple of typo-technological divergence. Apart from the strikingly low proportion of the element under study, another noteworthy feature of this group is the high to very high frequency of cleaver. Cleaver is not only the prepondering type but occupies more than 30% of the finished tools. Advanced Acheulian character of the industries of this group *i.e.*, Lalitpur, Chhatar Palia, Chirki-Nevasa and Nagarjunakonda-1, is also confirmed by the presence of a good proportion of finely worked handaxes. Chopper-chopping element here does not exceed 7% of the finished tools.

This situation forms a typological character of a few Acheulian industries. The nature of raw material also seems to be responsible for the unusually lower proportion of the chopper-chopping tools in these industries. It may be recalled that, except for Nagarjunakonda valley, where pebbles were abundant there was a scarcity of water borne pebbles at all other sites. This form of raw material is best suited form making chopper-chopping tools. But, at Lalitpur, Chhatar Palia and Chirki-Nevasa the open-air Acheulian workshops the source of raw material was granite, quartzite and dolorite. These were available in the form of dykes or big blocks, and there is dearth of water borne pebbles at these sites. Similar situation was noted at Bhimbetka and Paisra. Excavations of one of the rock-shelters at Bhimbetka, by Misra, revealed a rich Acheulian debris. Here too advanced Acheulian trend is accompanied by a high frequency of cleavers and a near absence of chopper-chopping tools. Scarcity of pebbles is noteworthy in this case also. In the other cases *i.e.*, the Acheulian workshops at Hunsgi and Paisra, though cleavers do not fare very well, the absence of the pebbles coincides with the very small quantity of chopper-chopping tools.

The number of choppers and chopping tools in this group is small, yet considerable thought appears to have been given to the selection of raw materials for making this category of tools. Chunks which had acquired roughly rounded form due to the weathering processes were particularly selected for the purpose. The other form preferred was flat-based stone pieces. The former was coverted into chopping tools, while the ones with flat surface into choppers. Chirki-Nevasians seem to be in comparatively advantageous position in utilizing rounded stones, as the chemical weathering of dolorite produces medium sized rounded stones. Incidentally the ratio of choppers to chopping tools here is 1 : 9. 3. The variation narrows down considerably in Lalitpur (1 : 2), where rounded stones were not available in such a great quantity. The position, however, reverses at Paisra, where we could notice mere absence of weathered round stones. Thus, the use of flat-based stones was a prevalent practice. The ratio of chopper and chopping tool here is 7 : 1.

2. INDUSTRIES WITH MEDIUM FREQUENCY RANGE OF CHOPPER-CHOPPING TOOLS

This group is formed by typical Acheulian industries and is spread in a wider area. The trend seems to be prevalent particularly in Rajputana, Malwa, Adamgarh group of industries of the Narmada valley, Son valley, West Bengal, Orissa and the area lying south of the Narmada basin. It may also be emphasised that the tendency is pronounced even in the Kortalayar valley, generally regarded as the home of the Madrasian Culture.

Overwhelming Acheulian workmanship in the tool-kits is seen in the form of high frequency of handaxes and the followup by cleavers. Chopper-chopping element in these range between 10% and 20% of the finished tools. Thus, the frequency range 10—20% may be taken to be a standard proportion of the chopper-chopping element in the typical Acheulian culture complex. In other words, the element under study may be taken as an integral part of the Acheulian culture of the Indian sub-continent. Chopping tools are more than choppers in these industries and the variation of the chopper : chopping tools ranges between 1 : 1.72-3.50.

3. INDUSTRIES WITH HIGH TO VERY HIGH FREQUENCY OF CHOPPER AND CHOPPING TOOLS

In this group of industries the frequency of chopper-chopping element is invariably more than 30% of the finished tools, and in a very few cases, it reaches 60%. The Acheulian fossil tool types, though are well represented they in some industries are sub-ordinated by the chopper-chopping element. The group is represented by Bariarpur in the Ken valley ; Mahadeo Piparia and Durkadi in the Narmada valley ; Anagwadi in the Upper Krishna valley and Vaddamanu in the Pennar valley. Traces of the trend are also reported from parts of Gujarat. The situation of these sites, away from one and the other, clearly suggests that the trend does not seem to be confined to a particular region. Furthermore, the high frequency of chopper-chopping tools cannot be explained simply by pointing towards easy availability of raw material. Thus, in every likelihood it is a specific culture trait, which seems to prevail in a part of the Acheulian complex of this sub-continent.

Chopping tools in general are more in number than the choppers in these industries, as well. This character tallies well with the preceding group. For instance, in

Bariarpur, Mahadeo Piparia, Anagwadi and Vaddamanu industries, chopping tools have a ratio variation range against one unit of chopper to 2.37—3.90. Only exception is the Durkadi industry, where choppers outnumber the other (5.66 : 1). This feature is closer to the trend seen in the exclusively chopper-chopping industries. Besides, representation of the Acheulian implements is also very poor in the Durkadi industry, which suggests a strong inclination of this industry towards the exclusively chopper-chopping tradition.

4. EXCLUSIVELY CHOPPER-CHOPPING INDUSTRIES

As described earlier, this group is devoid of Acheulian implements, as well as, any type of specialized tools. The mojor part of the tool-kit comprises chopper and chopping tools and at times a nominal proportion of crude scrapers made on primary flakes. Distribution of such localities indicates a regional pattern, as indicated by the concentration of this trend in the peri-glacial region of the Extra Peninsula. Density of exclusively chopper-chopping sites decreases considerably as one moves from the Potwar region to the east and the south. There are only a couple of sites in the Peninsular India *viz.*, Lahchura and Betwa groups in Uttar Pradesh and Nittur in Mysore.

The most striking typological character of the exclusively chopper-chopping group of assemblages is the dominance of choppers over the chopping tools. This feature is more pronounced in the Extra Peninsula and to some extent in southern Uttar Pradesh. The situation, however, reverses in Nittur, the southern most site, where chopping tools preponderate the assemblage in 3 : 1 ratio. The exceptional case of Nittur in this regard has closer affinities with the typical Acheulian industries of the Peninsular India.

It becomes apparent from the above account that with regard to the mode of chopper-chopping tool making and also the distribution pattern, the Fourth group of exclusively chopper-chopping industries falls apart from the other three. In the remaining three industries, except for the fluctuation of the percentage of the element under examination and some of the Acheulian type of implements, no distinct trend is visible. The marked typological trend in these three can at best be regarded as sub-groups of the large Acheulian culture-complex of this sub-continent.

II

Observations on the distribution of the chopper-chopping element and the handaxe-cleaver element by Krishnaswami had initiated the debate on the possible existence of two culture-traits in the Lower Palaeolithic facies of the Indo-Pakistan sub-continent. The concentration of Acheulian locales in the Peninsula, and that of the exclusively chopper-chopping sites in the Extra Peninsula, provided main basis for the view held by him. The factor responsible for such a culture-dichotomy according to him was the independent survival of the two groups of people *i.e.*, the handaxe making population of the Madrasian Culture and, the chopper-chopping tool users of the Soan region. It was further suggested, that these two perhaps lived in isolation for some time, but came into contact with each other in and around the area of Singrauli basin in due course. The discovery of a few handaxe yielding sites in the north-west explained by Paterson and Drummond in terms of the Acheulian invasion or intrusion into the nucleus region of the Soan Culture. As mentioned earlier, the theory of the existence of two cultures in the Lower Palaeolithic phase of the Indian subcontinent received wider acceptance in sixties, but, was later dropped. It is proposed to examine this hypothesis in the light of the issues emerging from the present study.

The seemingly regional patterning in the distribution of the chopper-chopping element on the Indian map was very much at the back of the mind of the scholars who favoured the existence of the two cultures of the Lower Palaeolithic phase. There has been a clear change in this direction after the discoveries made during the last two decades. As we had observed, the occurrence of this element has a uniform spatial distribution in which not a single region is such where complete absence of this element is viewed. The distribution of the two *i.e.*, exclusively chopper-chopping localities and the ones which have yielded both the Acheulian and the chopper-chopping elements, does, however, form a regional pattern. That is, concentration of the former in the north and the north-west and that of the Acheulian in the Peninsular India. Lahchura and Betwa group of sites of the southern Uttar Pradesh, may suggest a strong hold of the chopper-chopping trend in Central India. The isolated find of Mysore, Nittur, does not seem to be a true representation of this class. This pattern would, thus, seem to correspond with the hypothesis postulated by Krishnaswami.

The later investigations have brought to light the fact that chopper-chopping tools form an integral part of the Acheulian tradition in this region. This fact was denied by Krishnaswami, who held that the Madrasian Culture was devoid of Soanian element. It is surprising indeed that how in his field investigations in the Kortalayar basin he could miss the presence of this element. As the visit of the area by the present author and also the examination of the collections from the area revealed that chopper-chopping element is well represented there. The preceding discussion showed that the chopper-chopping tools in general form 10 to 20% of the finished tools in typical Acheulian industries, and there are some areas where still higher frequency of this element is seen.

Extensive spread of the chopper-chopping element on the one hand and concentration of the exclusively chopper-chopping assemblages in a limited area on the other, bring us back to the basic question whether the element in the two groups represents two basically divergent culture traits? For finding a suitable explanation to it a comparison between a representative industry of the Peninsular Acheulian *viz.*, Vadamadurai and the groups of the early Soan is attempted. It was noticed that the Soan types 3 and 7 were not present in the Vadamadurai industry. Similarly, typical forms of the Lower Soan and the Middle Soan *i.e.*, Soan type 6, the convex edged choppers made on flat-based pebbles is unrepresented at Vadamadurai. However, there are a few similarities between the Soan types 1, 2, 4 and 5, and the Vadamadurai flat-based choppers and chopping tools made on round pebbles. Choppers on split pebbles also occur in small numbers in the Soan of the Middle Pleistocene epoch. The tendency to notch the edge is well marked at Vadamadurai, and this is also present in the Middle Soan. Similarly, the pointed chopper on a naturally flat-based pebble of Vadamadurai industry seems to match with the Soan type 5. It is apprent from this comparison that although there are similarities between the Soan choppers and chopping tools, and that of Vadamadurai, they are mainly between the atypical forms. The points of correspondance are more with the Middle Soan tool-kit, as compared to the earlier Soan group of tools.

It was also noticed that the practice of making choppers and chopping tools follows entirely different pattern in the exclusively chopper-chopping industries than is prevalent in the Acheulian tool-kits. That is, choppers are invariably more numerous in the former and in the latter the chopping tools. Besides, there is also a difference in the technological process in the two group of industries. For example, Acheulian mode of careful flaking in the form of more than a series of controlled flaking, characterizes a number of the choppers of the typical Acheulian industries (cf. Fig. 15—1, 2; Fig. 15—4; Fig. 21—1, 3 ; Fig. 20—1) On the contrary atypical forms are much in vogue in the Acheulian tool-kits (Fig. 15—2, 5, 6; Fig. 18—2, 4; Fig. 19—2, 3; Fig. 21—4). The size of choppers and chopping tools is comparatively smaller in the Acheulian than in the exclusively chopper-chopping group.

All these facts taken together suggest that the north-western and northern part of the Indian sub-continent was perhaps under the influence of the South-East Asiatic chopper-chopping spread. At the same time making of the categories of implements under study was also prevalent in the Acheulian culture tradition. But this was modified in accordance with the Acheulian mode of working. In the absence of geo-chronological details of the Lower Palaeolithic industries, it would be difficult to interpret the above variations in terms of the culture movements etc.

III

On the basis of the technological considerations choppers and chopping tools generally form two separate categories. Yet, on the functional criterion some scholars are inclined to regard them as belonging to a single category. This aspect is well reflected in the arguments put forward by the scholars who suggest the use of the term

'Chopper' for both the technological categories *i.e.*, the unifacially worked and the bifacially worked specimens. The reason given is, that, the utility of a unifacially and a bifacially flaked edge of a pebble would be the same. Besides these controversies, a thought on the probable use of the two categories is also needed when there seems to emerge certain pattern in the relative distribution of the two types in various industries. For example, the preceding discussion showed that choppers preponderate in the exclusively chopper-chopping industries and chopping tools are in an overwhelming number in the Acheulian tool-kits. We are aware of the fact that possibility of subjective element is great in attempts of this kind. Yet, it may not be futile to do so with certain amount of caution. It is proposed to mention a few observations made during the study of the morphological features of the chopper-chopping categories and guarded explanations on the probable use of these.

Chopper and chopping tools seem to have more than one function. This presumption is based on two facts. Firstly, the exclusively chopper-chopping assemblages lack specialized forms of implements which are in vogue in the Acheulian industries. This would indicate that the two categories under study catered to all the functional needs of their users, which, in every liklihood was more than one. Secondly, a large variety of edge and butt forms and to some extent size and weight of the choppers and chopping tools would also suggest a number of ways of their use. A few noteworthy observations in this regard are mentioned hereunder.

In the choppers and chopping tools there are a few types which bear specific character and, thus, suggest specialized use. Form of edge of this category are of a very special kind. On the other hand a major proportion of these two morphological categories is marked by generalized characteristics. But, a closer scrutiny of the latter does suggest a number of groupings. Each of these has been numbered and explained. The basic criteria for the following grouping are the nature of the working edge, form of the butt and the variation in the dimension of the artefacts. The dimension-index considered here includes the length-breadth average of each of the artefact. The dimension-index range is also prallellelled with approximate weight-range. It may be mentioned clearly that the correlation of the size-index-range with the weight-range is based primarily on the counts of quartzite specimens.

1. *Chopping tools with zig-zag edge* — The zig-zag form of edge in this category is the result of a very special technological process *i.e.*, alternate flaking. Though difficult to explain its full functional significance, a special operation is suggestive in this case,

2. *Concave or notched edged specimens*—Seen mostly in choppers, this form also suggests special use, as in normal chopping or scrapping operations most of edge would not even touch the material on which it is used. It may, however, be effective for such works as smoothening of the wooden shaft, etc. Incidentally this form is very

limited in the collections examined by us, and seems to be associated with the industries of exclusively chopper-chopping group.

3. *Pointed chopper/chopping tools* — This also is a less frequent form of the palaeolithic artefact of this sub-continent. The heavy point and the considerable weight of the artefacts in this case might suggest digging operation which did not need very controlled blows.

4. *Denticulated specimens* — This form too is very specialized and suggests specialized working process. It was seen more associated with typical Acheulian tool-kits, and some of the later industries of the Soan facies as well. The type seems to have been used as heavy saw?

5. *Single stroked chopper* — The working edge in this case is restricted to a limited area of the periphary of the implements. It was perhaps used for such chopping cutting operations in which small working edge is required. The form characterised Central Indian exclusively chopper-chopping industries, and is very rare outside this region.

6. *Round or peripheral choppers* — It is difficult of attach a particular mode of use to this category.

7. *Generalized forms* — In most of the tool-kits it was noticed that flat-based pebbles or lump of stones which have one rounded face were converted into choppers. The medium angle flaking, *i.e.*, 50°-70°, could give an effective working edge to these. A similar form of edge was acquired on a round pebble by means of bifacial flaking in certain cases. Two different angles of working of the edge *i.e.*, low angle and medium angle are found in such chopping tools. Thus, both the types are marked by similar morphological characters.

The form of butt seems to provide important clues regarding the possible use of members of this group. These indications are provided by the nature of probable grip of the butt. the artefacts, which depends much on the size and shape of the butt. The preceding account of the morphological details of the choppers and chopping tools highlight the fact that butt may be located on the longer axis of a pebble on the shorter axis or at one of the ends the pebble having equal axes. Besides, the form of the butt may be straight, rounded or pointed/ V shaped. All these forms would provide four types of grip to medium sized specimens and two other types to the very large and very small specimens. For example, very large and considerably heavy implements would require holding by both the hands and the delivery of blow would be intense but less controlled. In the other extreme, the very small artefacts can only be used with the help of the grip of the fingers. Thus, it would fulfill the needs requiring careful scraping and controlled small cuttings. The possible ways of operations in case of the medium sized choppers and unspecialized chopping tools may be the following.

A. Lateral chopper and chopping tools with wide butt generally have straight or slightly rounded forms. Such an artefact is most convenient to hold breadth-wise, as the butt fits well into the natural curvature of the palm. The broad working edge in this case lies parallel to the palm. Specimens with 140 to 180 mm width are ideal for such a holding. An action requiring moderately heavy blow can effectively be performed with it. But, such an action for a longer period may not be very easy to accomplish. Since after each delivered blow the artefact will have to be placed in its original position, as the four fingers do not provide extra support to the holding of this class of implements.

B. Round butt or small straight butt is a frequent form in the pebbles with equal axes or long pebbles utilized length-wise. The butt of chopper and chopping tools in this situation, besides getting grip from the palm receives additional support from the four fingers. Chopping and rough scraping operations in this case can be effectively performed and is easy to repeat for some time.

C. Those choppers and chopping tools which have pointed or V shaped edge are difficult to hold in the above described manner. The pointed form of the butt fits well in the circle formed by the fore-fingers and the thumb. The entire hold in fact encircles the middle part of the implement. The most convenient action in this case is the repeated cutting operation like the one performed by an axe.

Two noteworthy forms are visible in the working edge of this group *viz.*, convex and straight working edge. It is however, difficult in the present state to evaluated the functional significance of the two.

The chopper-chopping tools of typical Acheulian industries generally are of smaller dimensions and rounded at the butt end. Variation in the form of butt as well as dimension are noticable more in the exclusively chopper-chopping tool-kits; than is found in the others. Besides convex and straight edges notched and denticulated edges are also prevalent in the Acheulian group. A cursory examination suggests that in Acheulian group of industries, limited and specialized use of the chopper-chopping element may be suggested, on the basis of less variation in the morphological features. On the other hand the heavy forms and variation in the butt, edge forms and dimensions indicate multiferous use of these categories in the other group. Besides, exclusively chopper-chopping tool-kits suggest a less skilled use of implements.

The above provisional hypothesis is based primarily on the observations of the morphological data and inferences based on logic. It is realized that detailed investigations aided with experimentation are required before accepting or rejecting the suggested hypothesis. It is planned to undertake such intensive investigation in future.

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Illustrations

DISTRIBUTION OF CHOPPER-CHOPPING TOOLS IN EUROPE ASIA & AFRICA

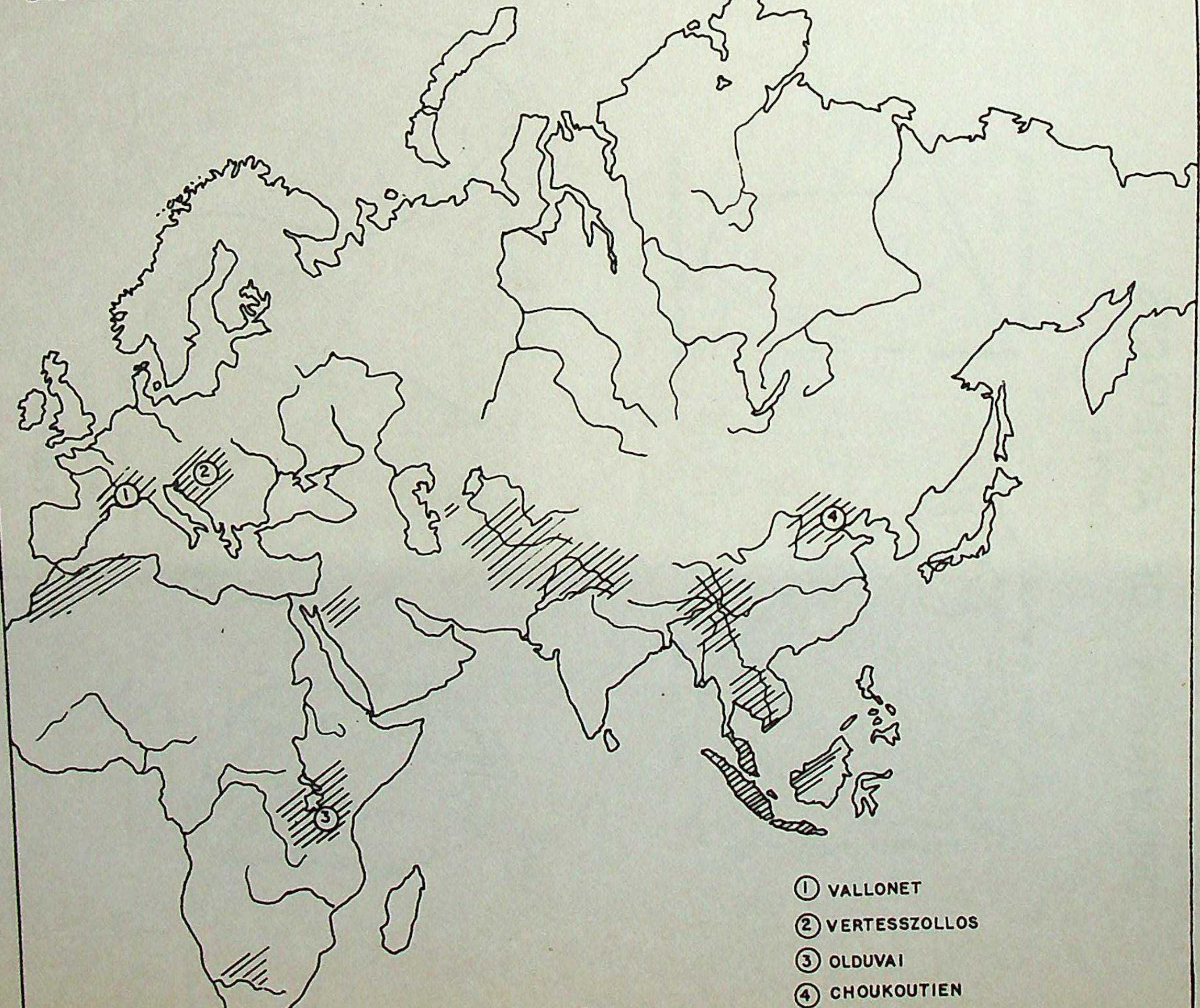
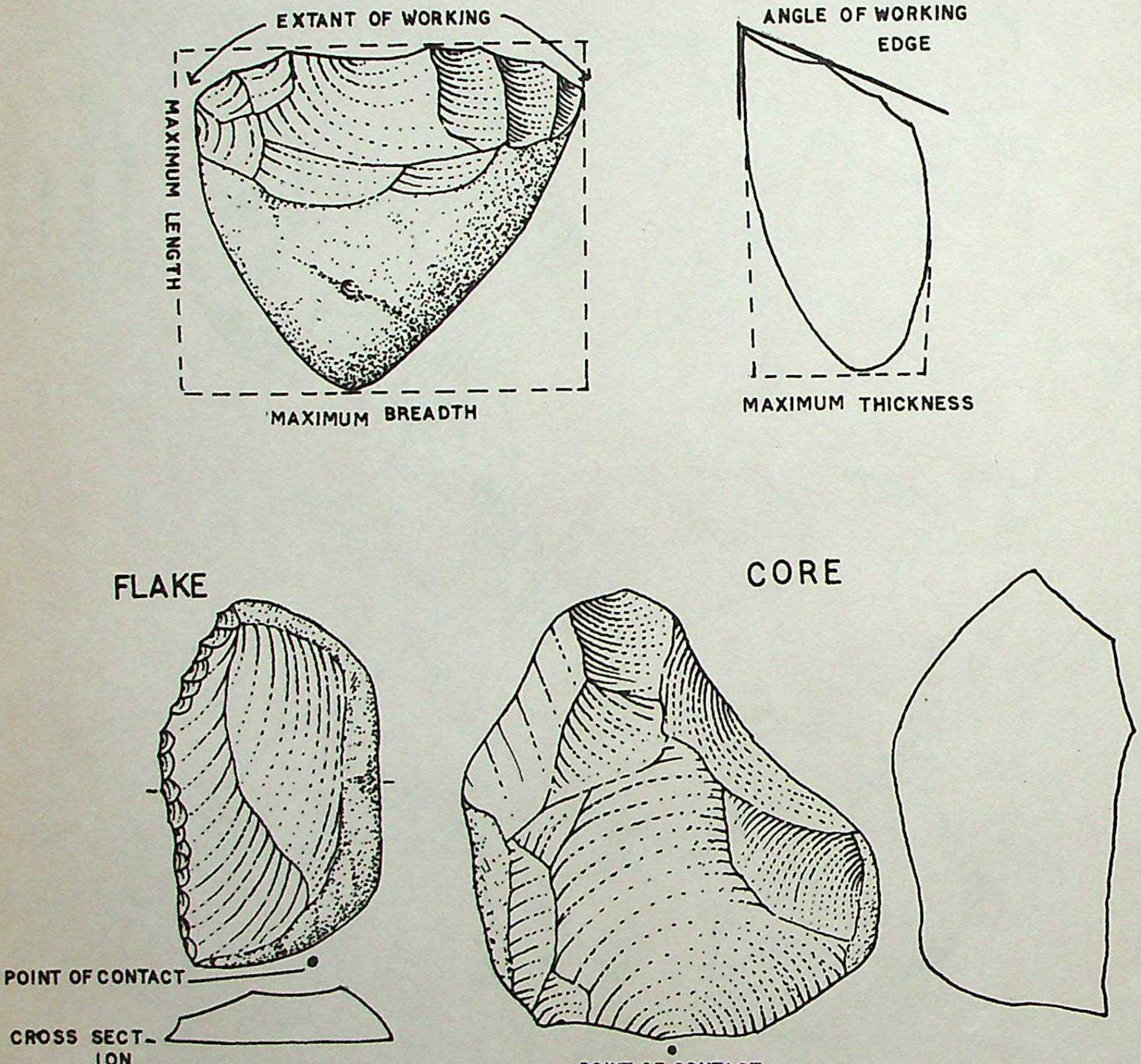

① VALLONET
② VERTESSZOLLOS
③ OLDUVAI
④ CHOUKOUTIEN

figure 1

ORIENTATION OF ARTEFACTS


CHOPPER

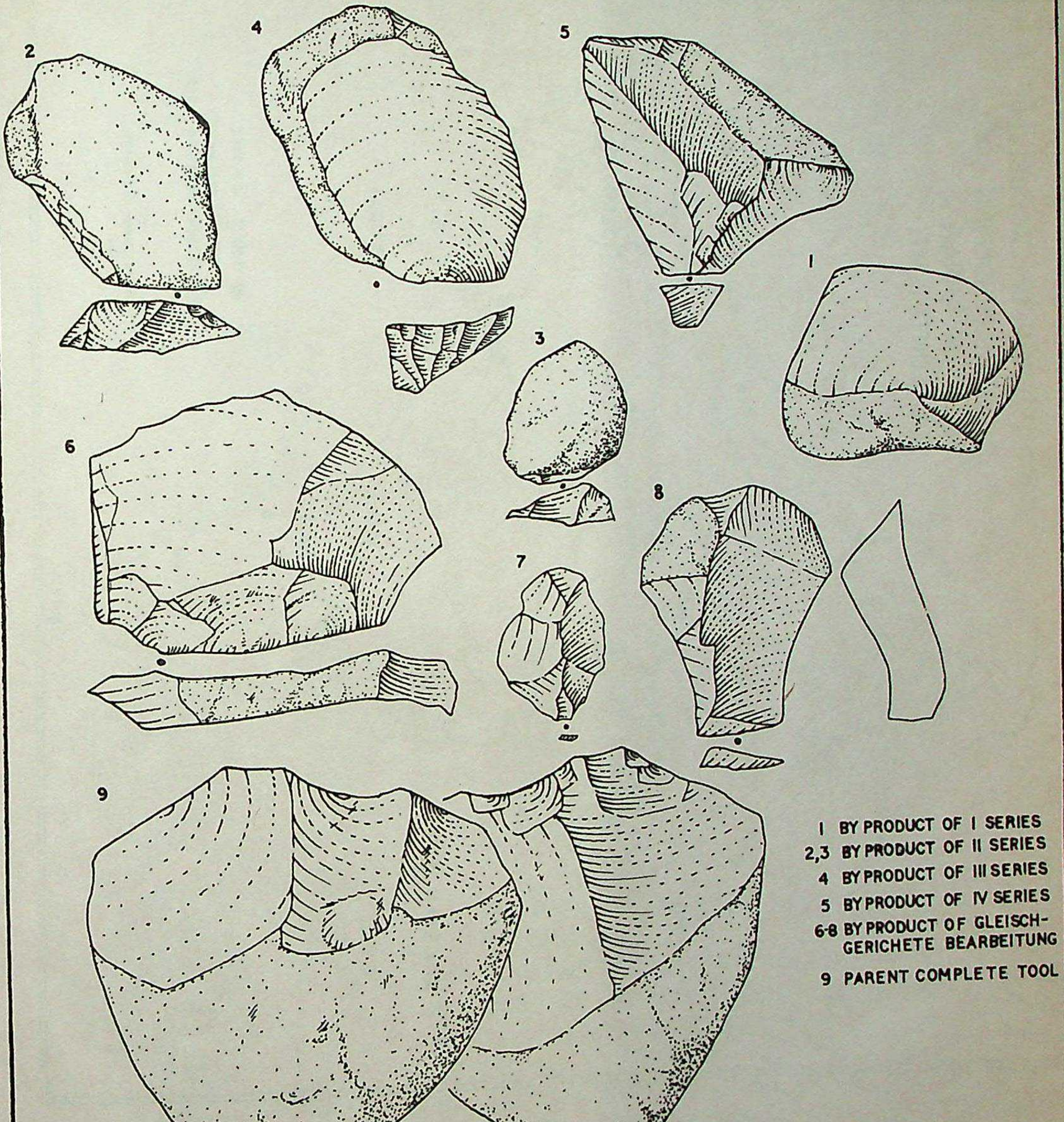
FLAKE

CORE

EXTANT OF WORKING
MAXIMUM LENGTH
MAXIMUM BREADTH
ANGLE OF WORKING EDGE
MAXIMUM THICKNESS
POINT OF CONTACT
CROSS SECTION
POINT OF CONTACT

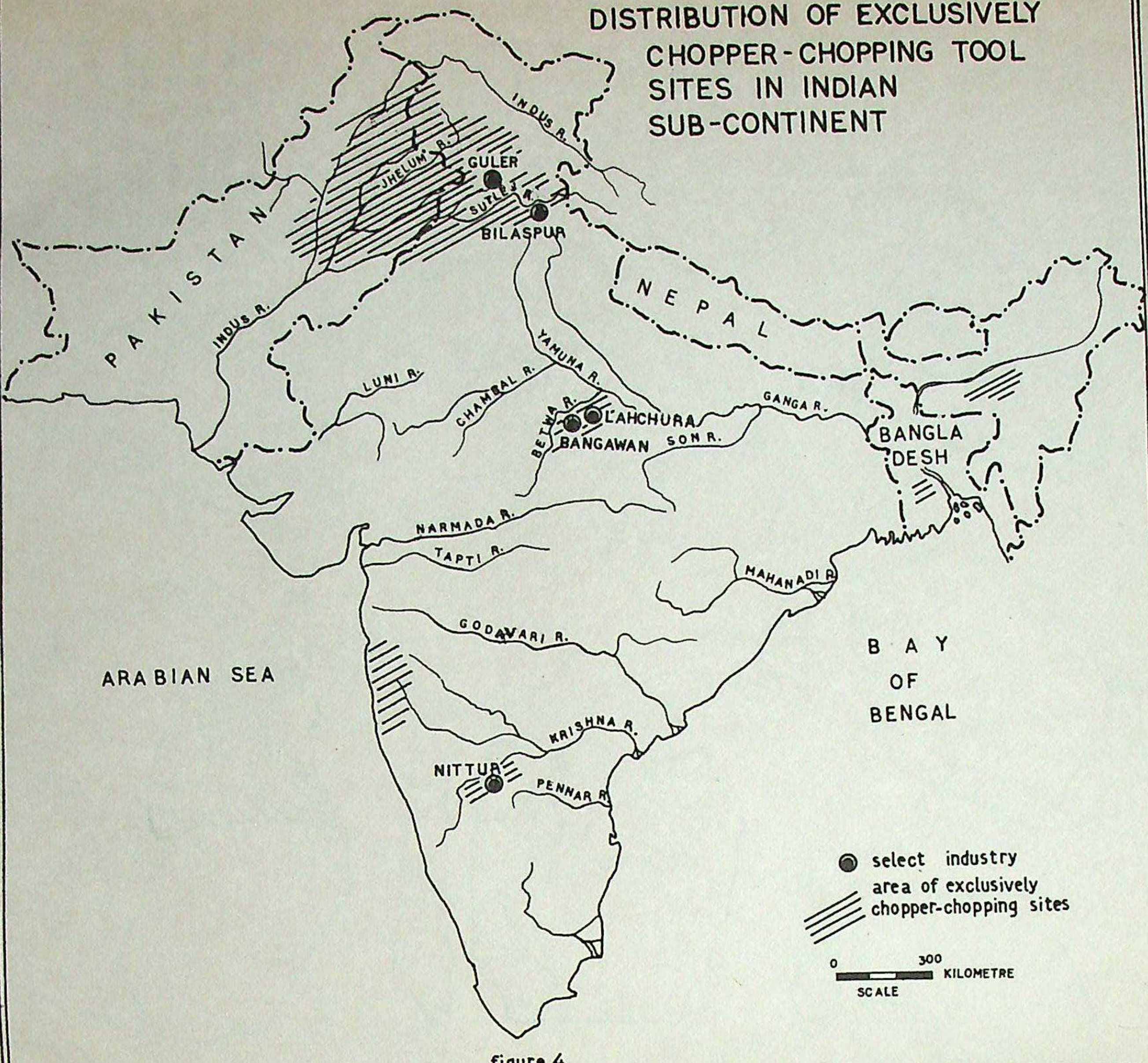
figure 2

BY-PRODUCT TYPES & FINISHED TOOL



1 BY PRODUCT OF I SERIES
2,3 BY PRODUCT OF II SERIES
4 BY PRODUCT OF III SERIES
5 BY PRODUCT OF IV SERIES
6-8 BY PRODUCT OF GLEISCH-GERICHETE BEARBEITUNG
9 PARENT COMPLETE TOOL

figure 3



DISTRIBUTION OF EXCLUSIVELY CHOPPER-CHOPPING TOOL SITES IN INDIAN SUB-CONTINENT

INDUS R.
JHELUM R.
GULER
SUTLEJ R.
BILASPUR
PAKISTAN
INDUS R.
NEPAL
LUNI R.
CHAMBAL R.
YAMUNA R.
BETWA R.
LAHCHURA
BANGAWAN
SON R.
GANGA R.
BANGLA DESH
NARMADA R.
TAPTI R.
MAHANADI R.
GODAVARI R.
KRISHNA R.
NITTUR
PENNAR R.
ARABIAN SEA
BAY OF BENGAL
● select industry
▨ area of exclusively chopper-chopping sites
0
300
KILOMETRE
SCALE

figure 4

SOAN TYPES OF PATERSON & DRUMMOND

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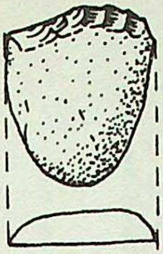
1



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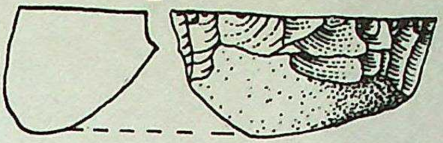
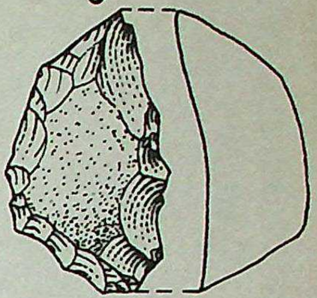
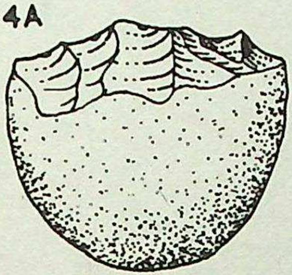


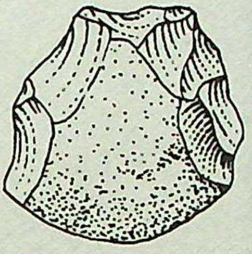
3



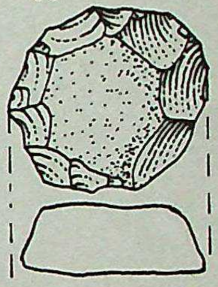
4A



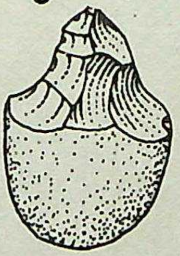
4B



4C



5



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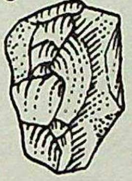
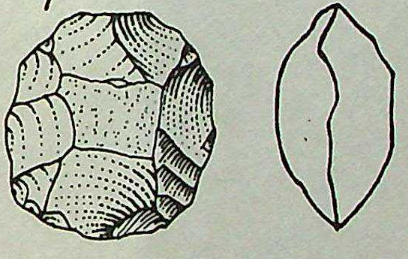
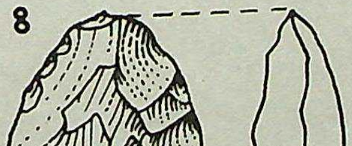


7

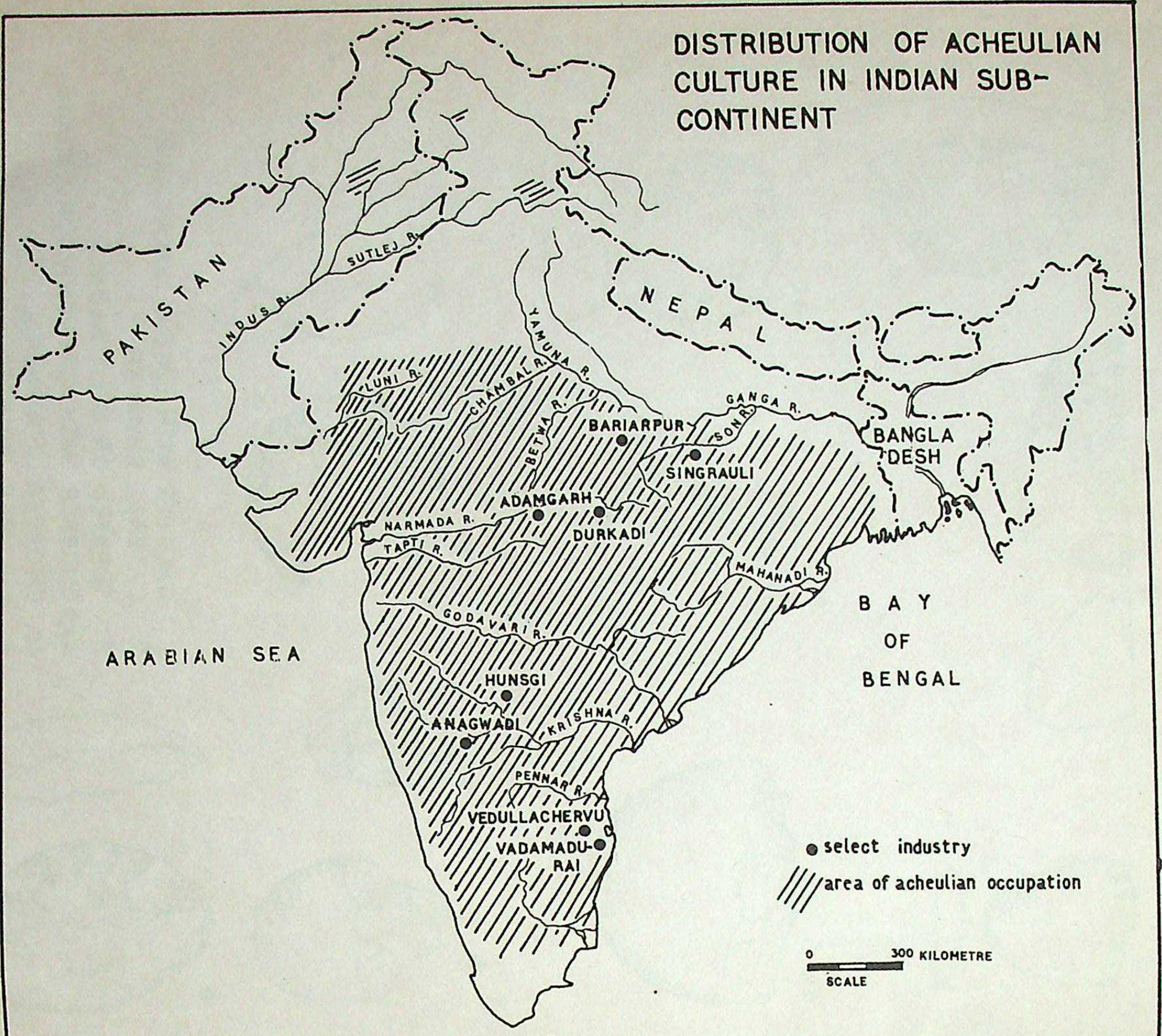


8



1 CHOPPER WITH EDGE AT SHORT AXIS
2 LATERAL CHOPPER
3 SCRAPER ON SPLIT PEBBLE
4AB CHOPPER WITH STRAIGHT/CONVEX EDGE
4C CHOPPER PERIPHERAL
5 CHOPPER POINTED
6 LATERAL CHOPPING TOOL/CORE
7 CHOPPING PERIPHERAL
8 UNIFACE OVAL

figure 5



DISTRIBUTION OF ACHEULIAN CULTURE IN INDIAN SUB-CONTINENT

PAKISTAN
INDUS R.
SUTLEJ R.
NEPAL
YAMUNA R.
LUNI R.
CHAMBAL R.
BETWA R.
GANGA R.
SON R.
BARIARPUR
SINGRAULI
BANGLA DESH
ADAMGARH
DURKADI
NARMADA R.
TAPTI R.
MAHANADI R.
GODAVARI R.
ARABIAN SEA
BAY OF BENGAL
HUNSGI
ANAGWADI
KRISHNA R.
PENNAR R.
VEDULLACHERVU
VADAMADU-RAI
● select industry
▨ area of acheulian occupation
0
300 KILOMETRE
SCALE

figure 6

BILASPUR

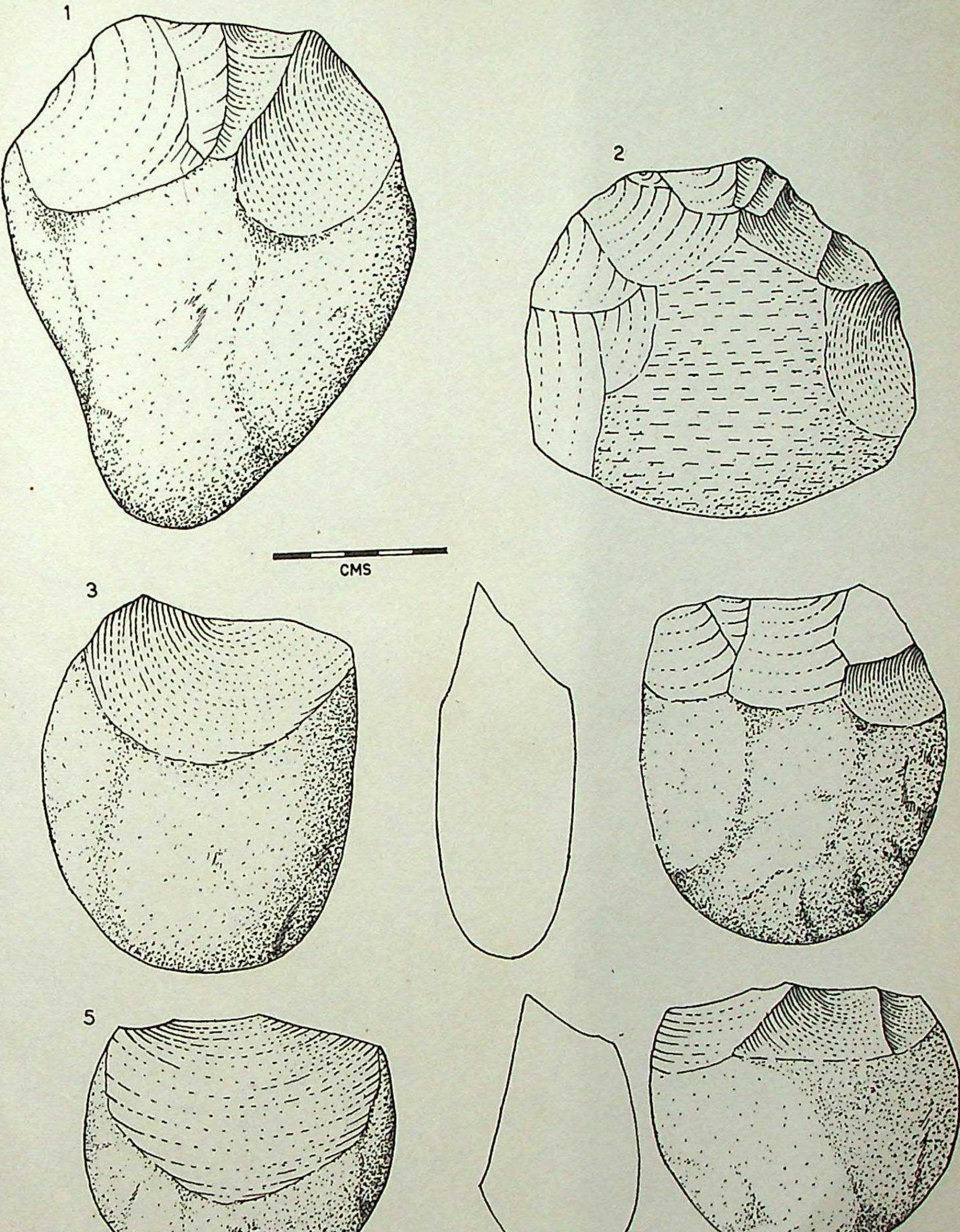


figure 7

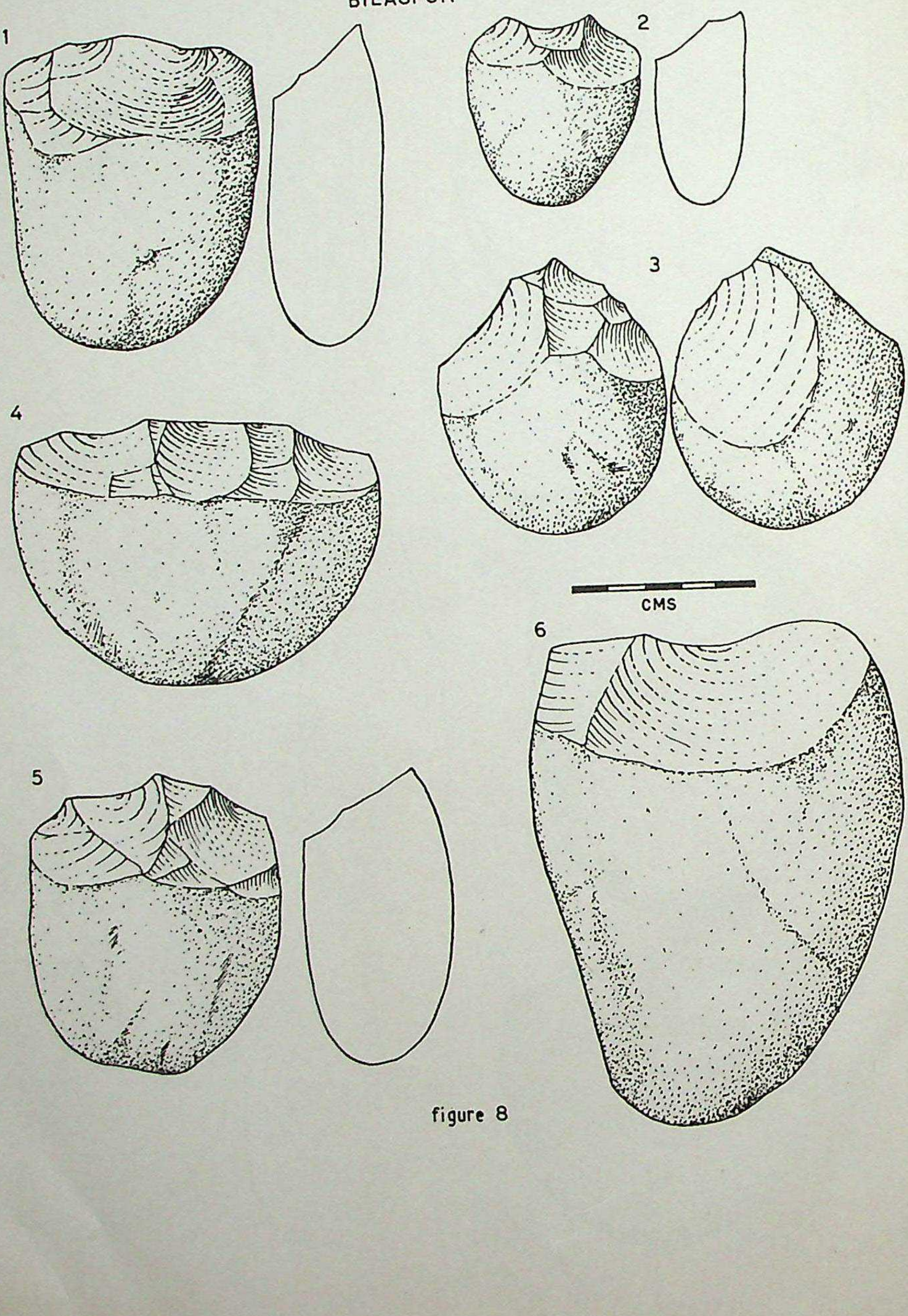

BILASPUR
1
2
3
4
CMS
5
6

figure 8

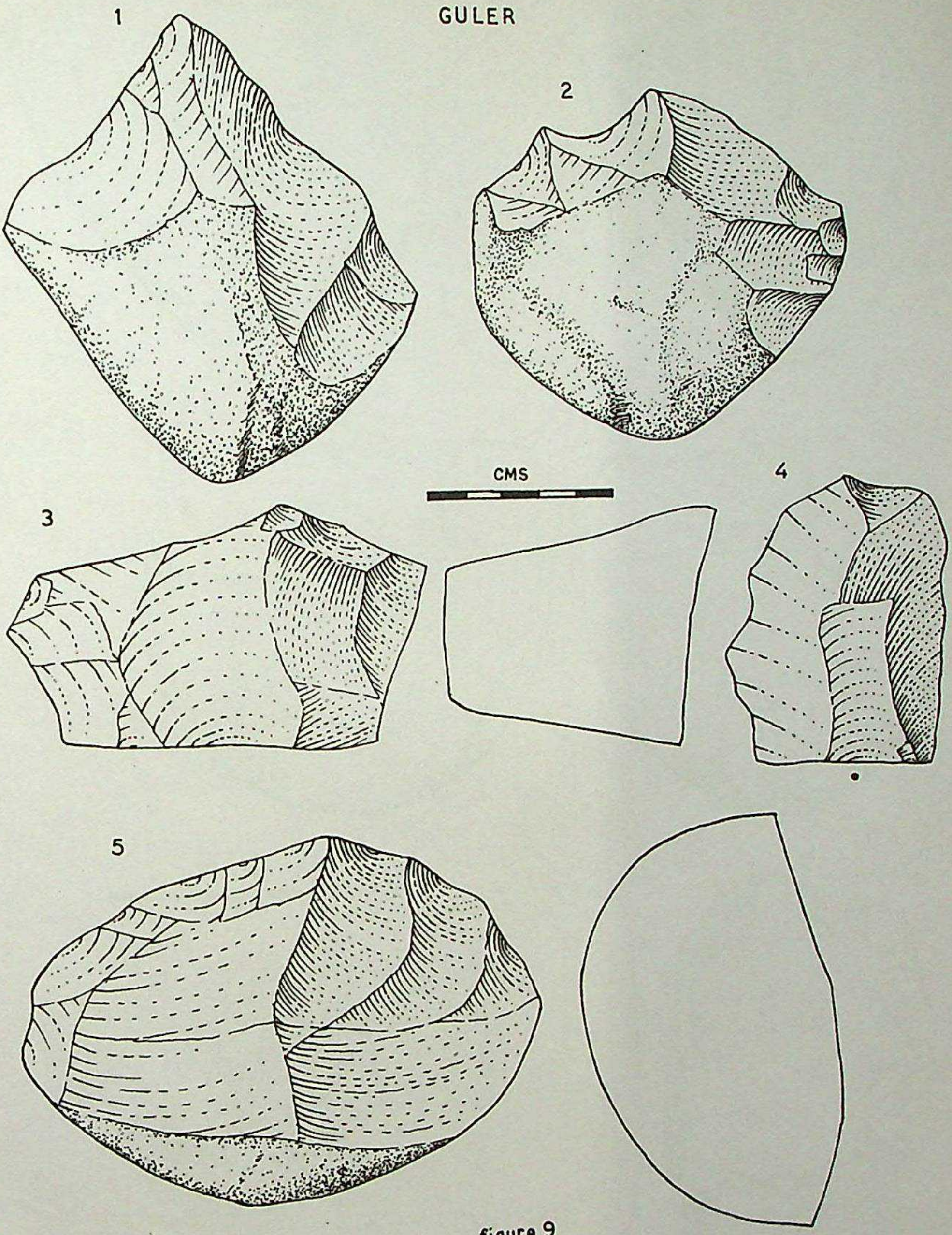

GULER
1
2
CMS
3
4
5

figure 9

LAHACHURA

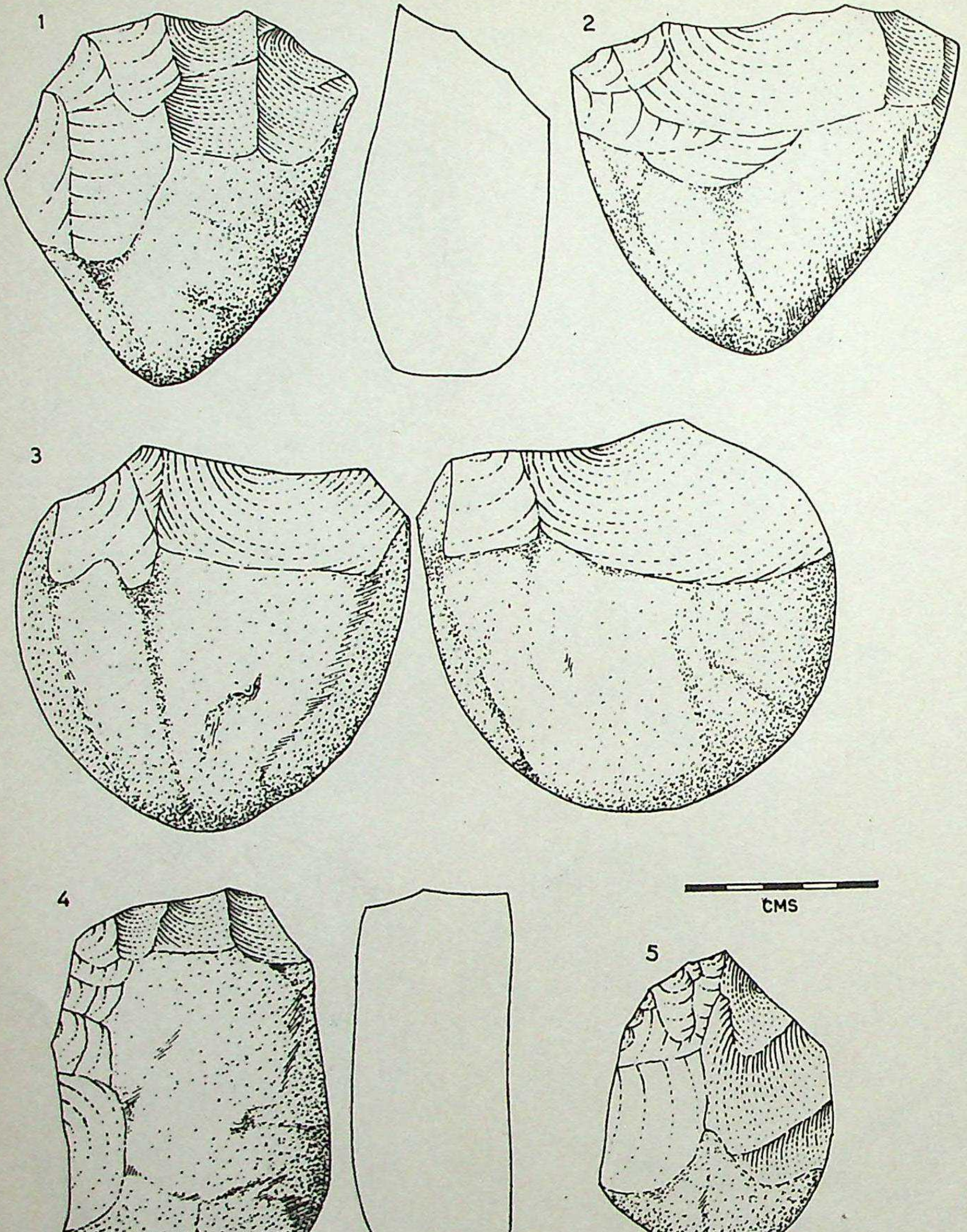
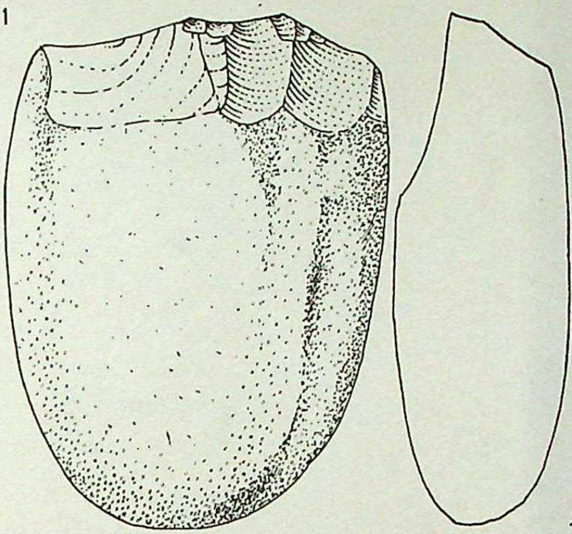


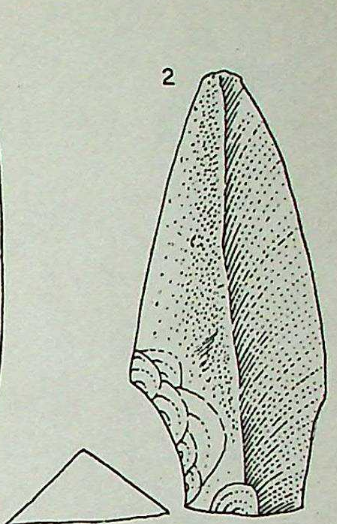
figure 10

BANGAWAN

1

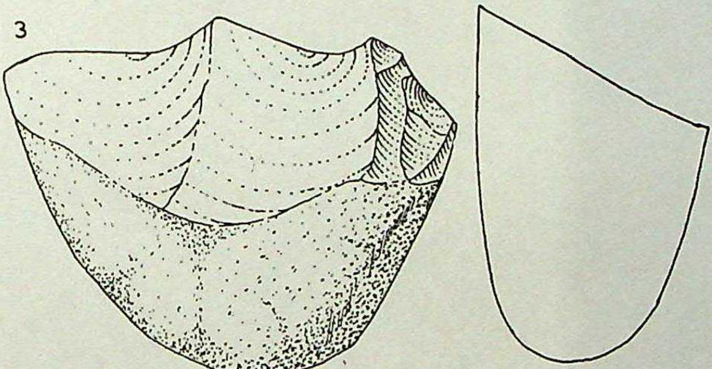


2



CMS

3



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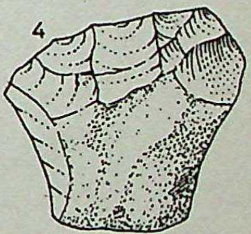

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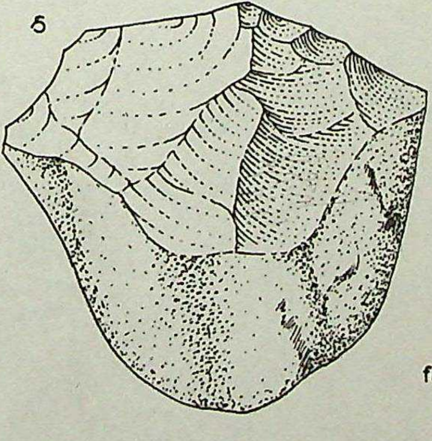

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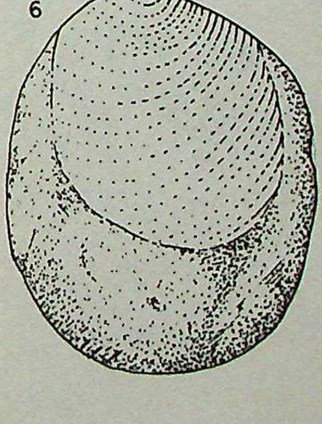


figure 11

NITTUR

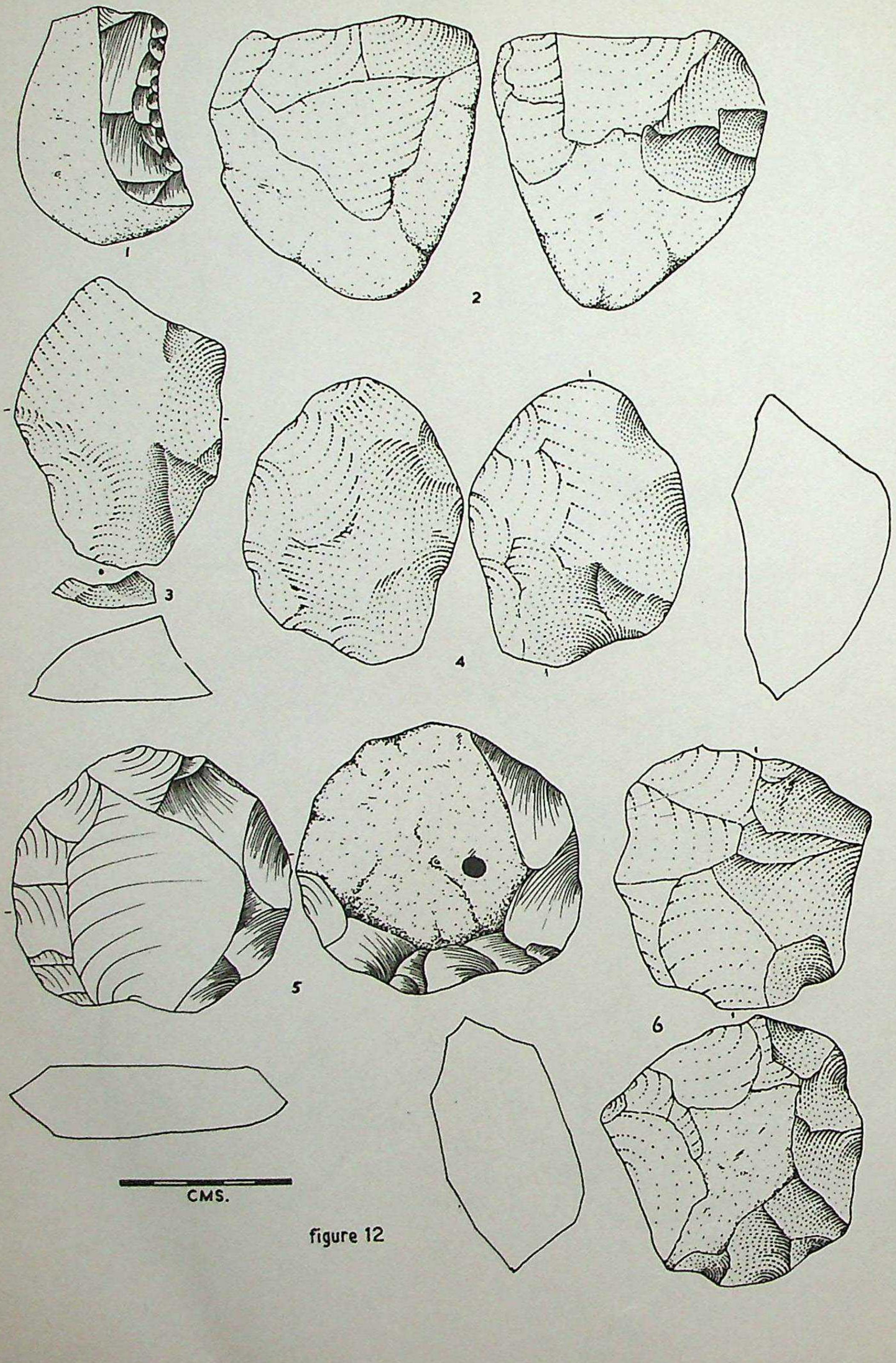


figure 12

BARIARPUR

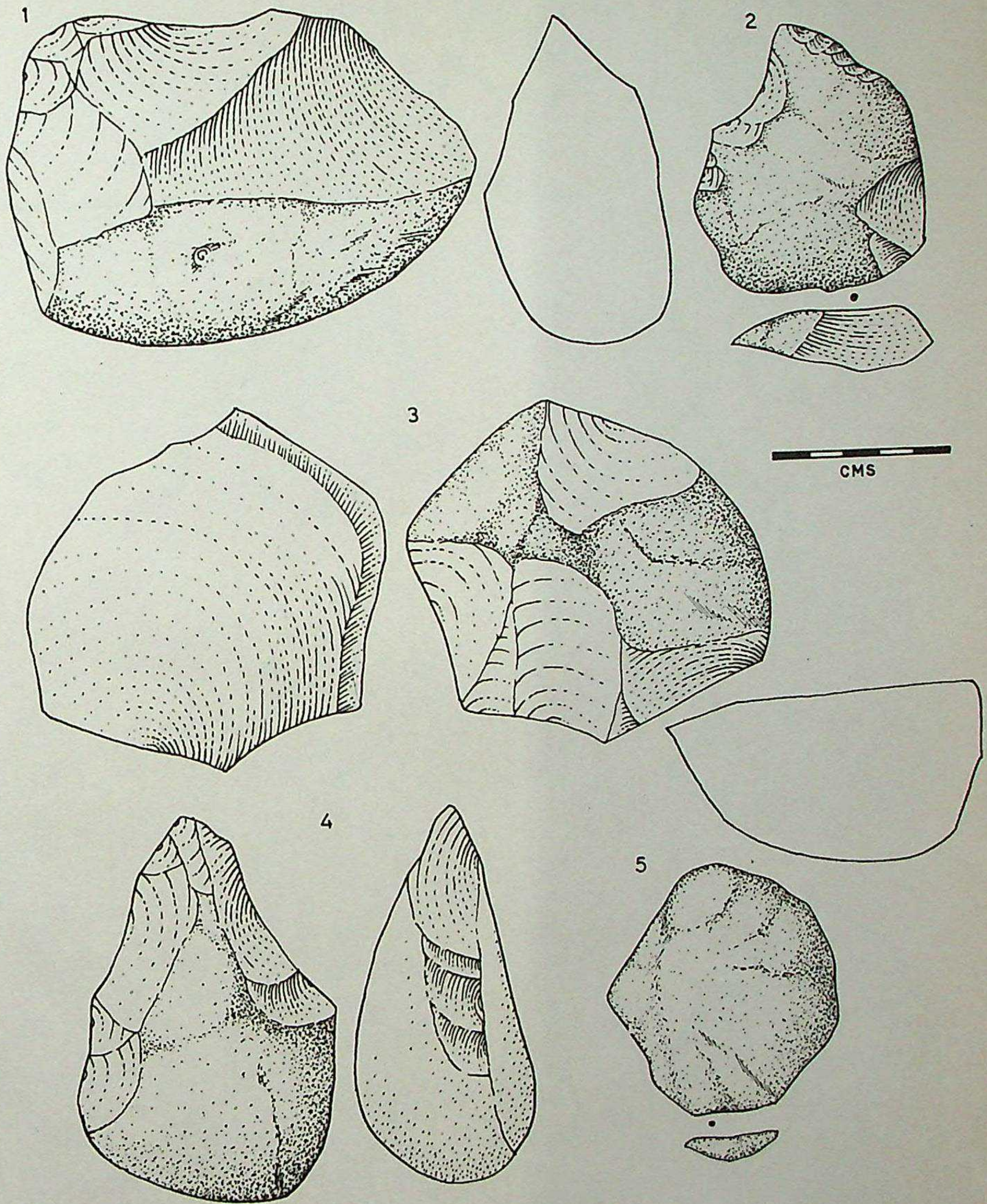


figure 13

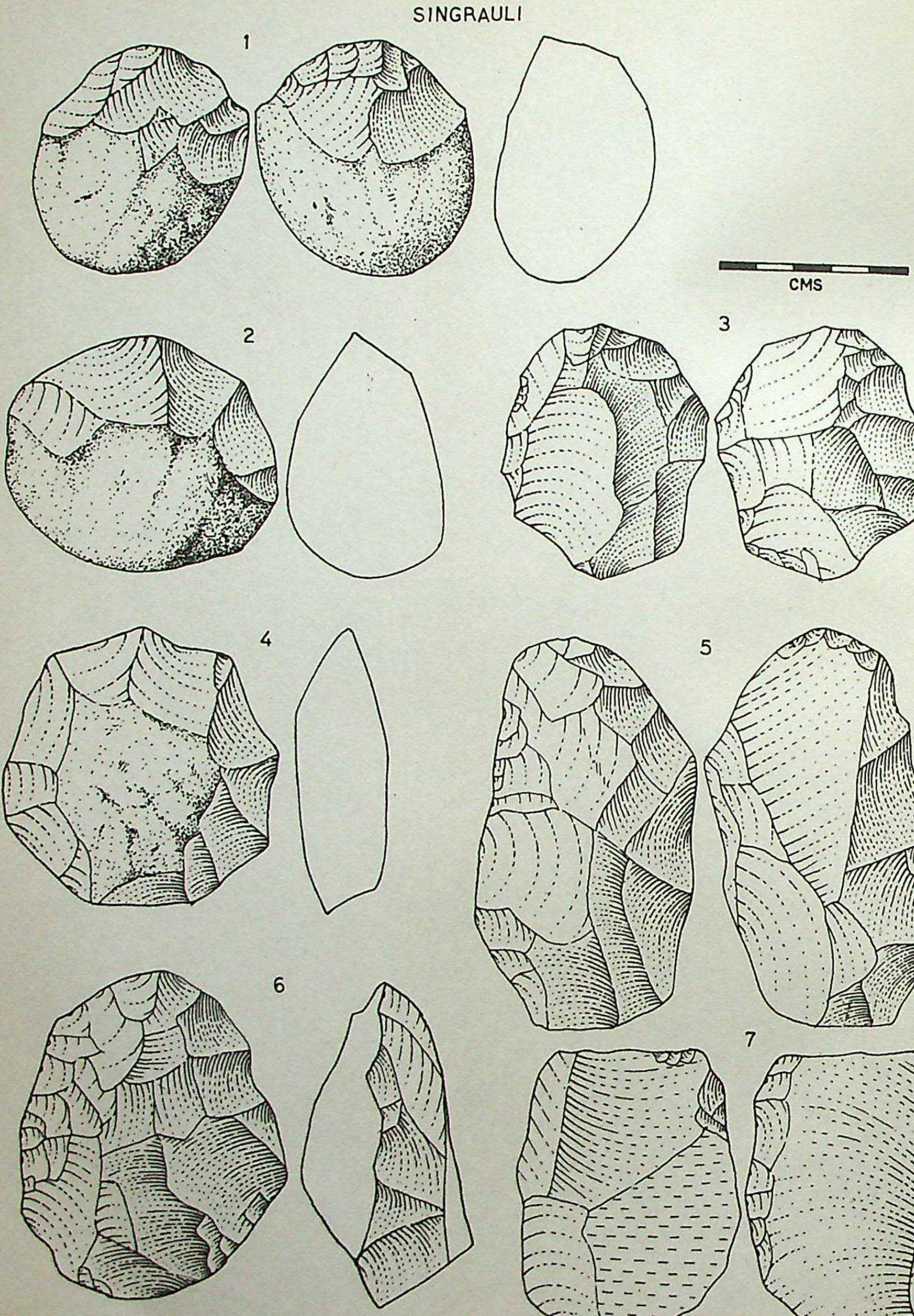

SINGRAULI
1
CMS
2
3
4
5
6
7

figure 14

ADAMGARH

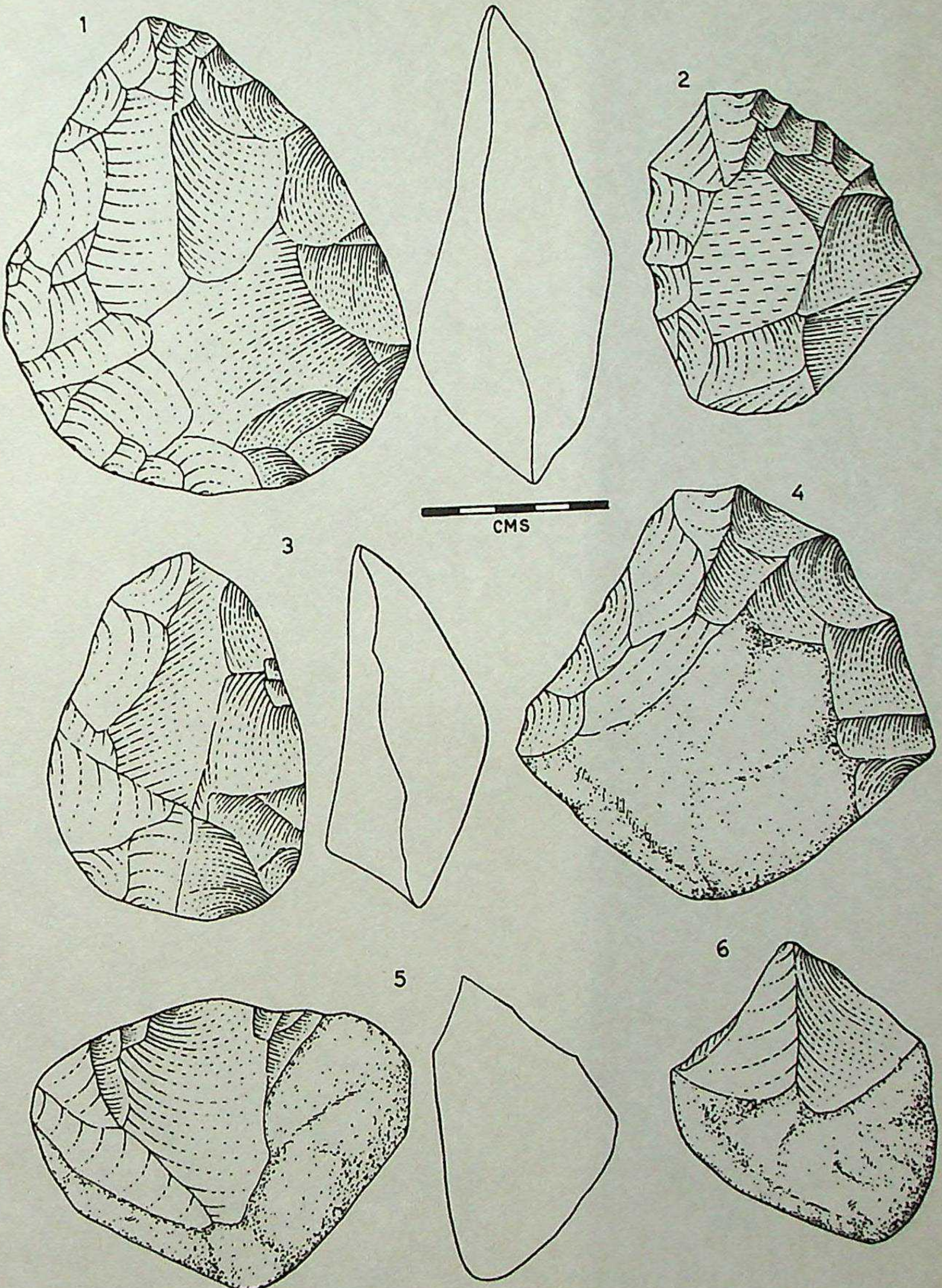


figure 15

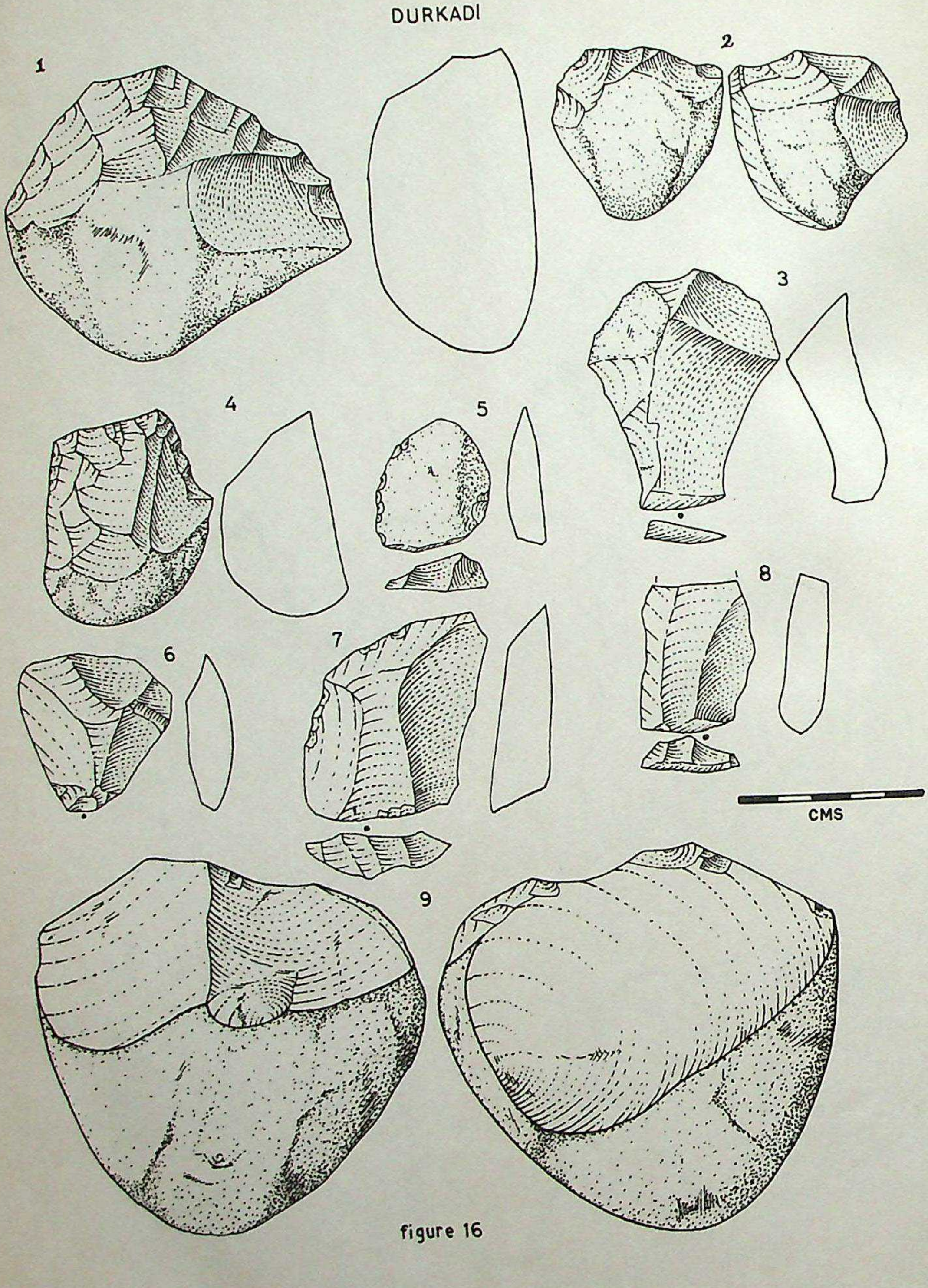

DURKADI
1
2
3
4
5
6
7
8
9
CMS

figure 16

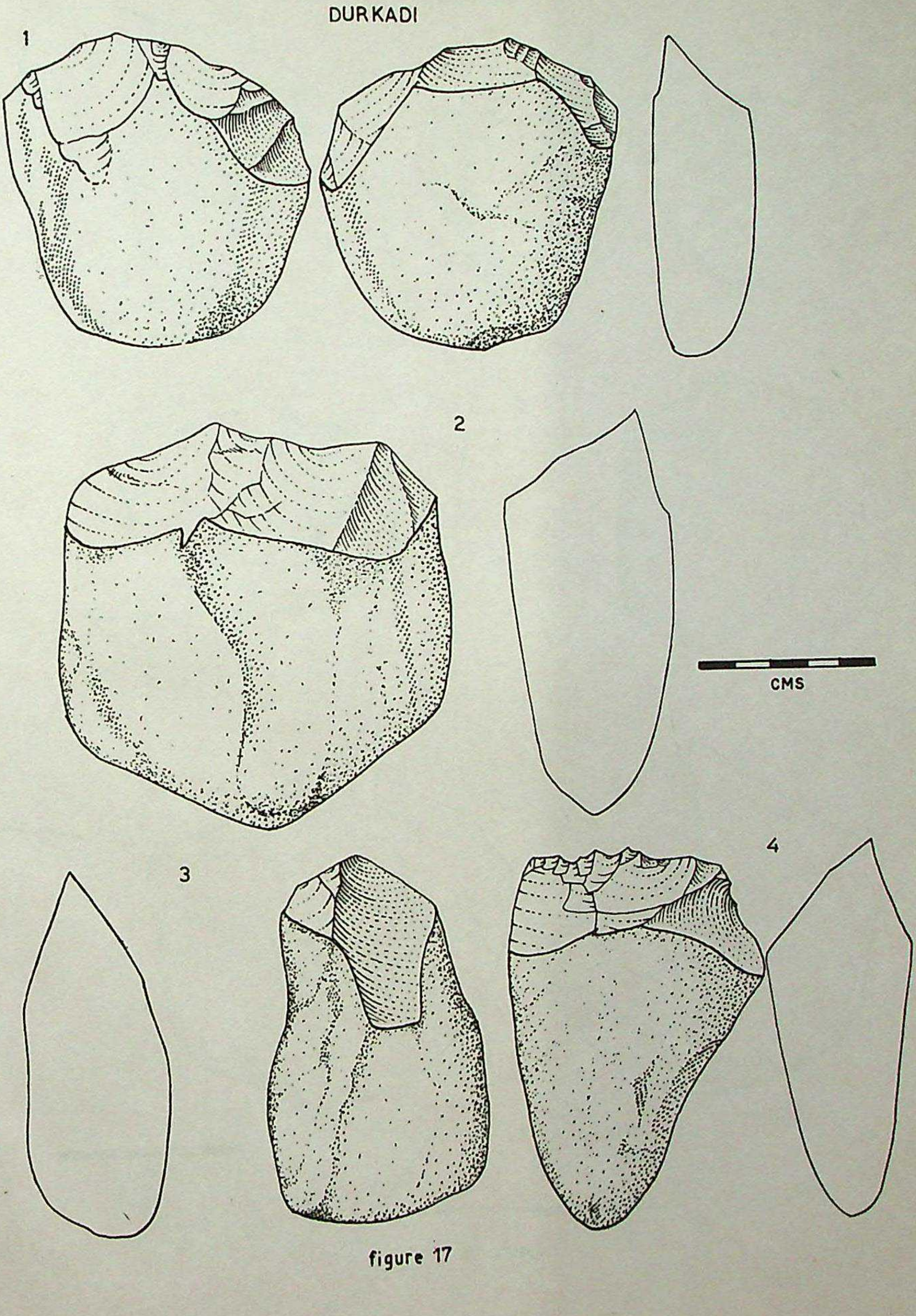

DURKADI
1
2
CMS
3
4

figure 17

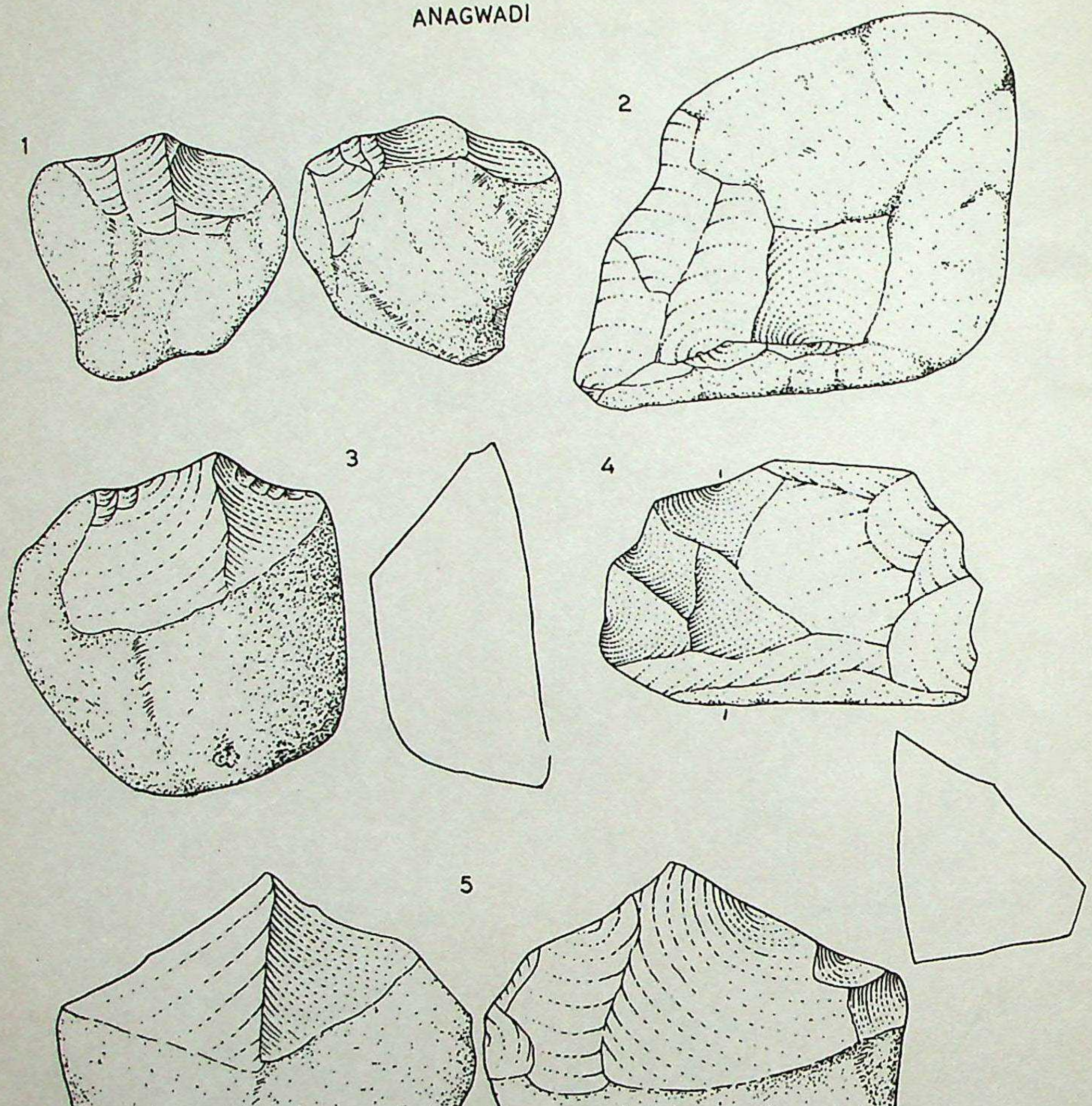

ANAGWADI
1
2
3
4
5
CMS

figure 18

HUNSGI

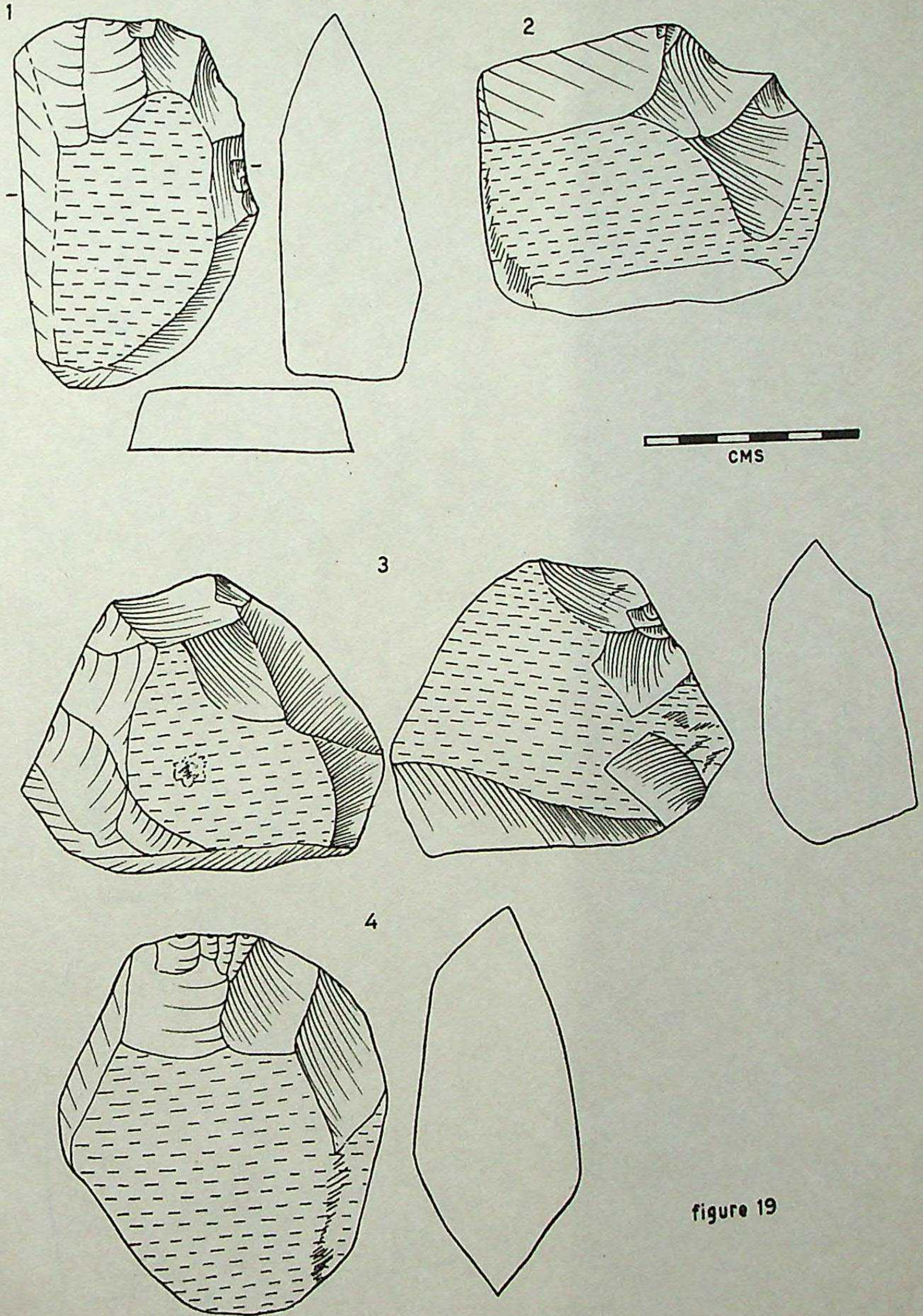


figure 19

VEDULLACHERVU

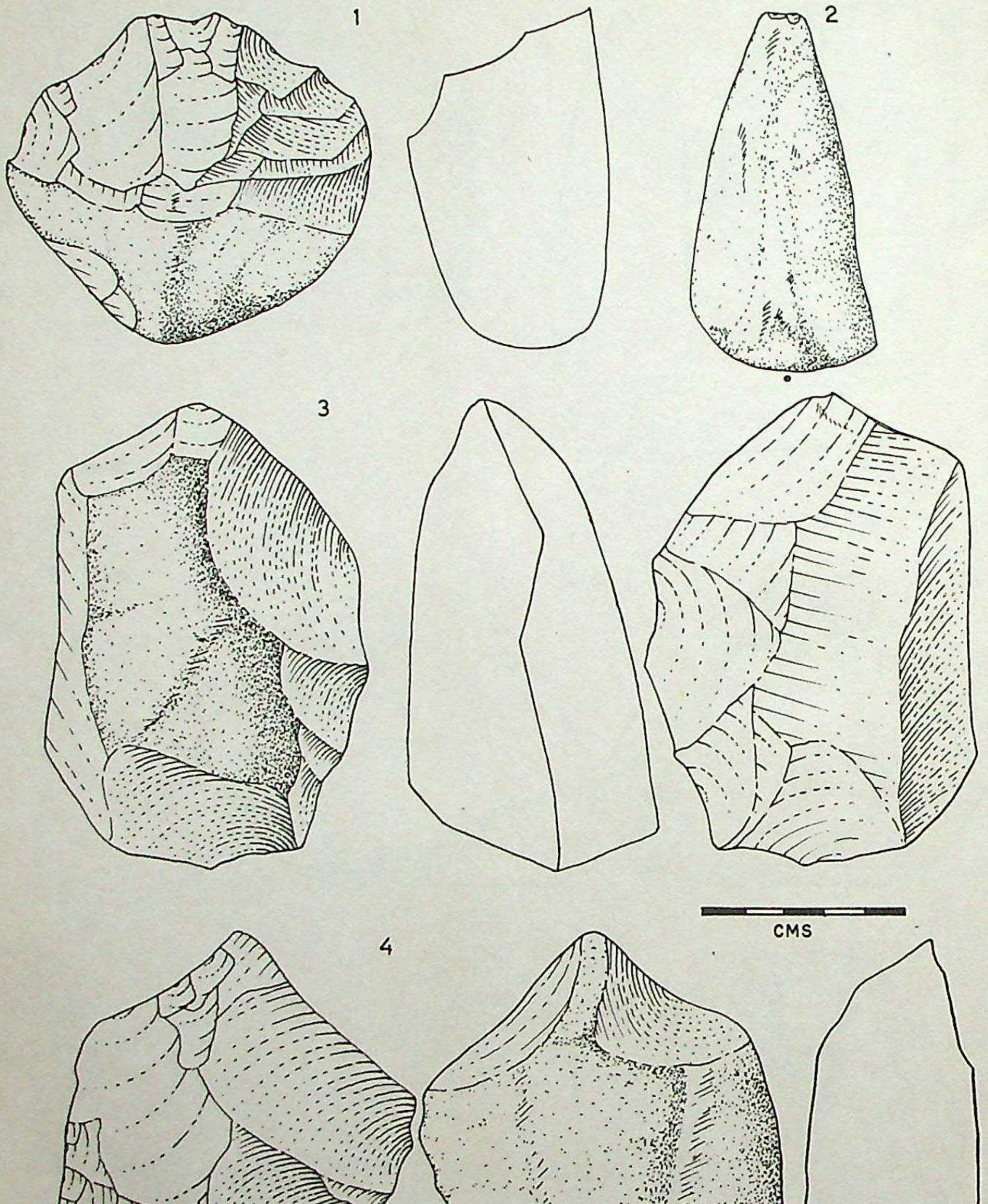


figure 20

VADAMADURAI

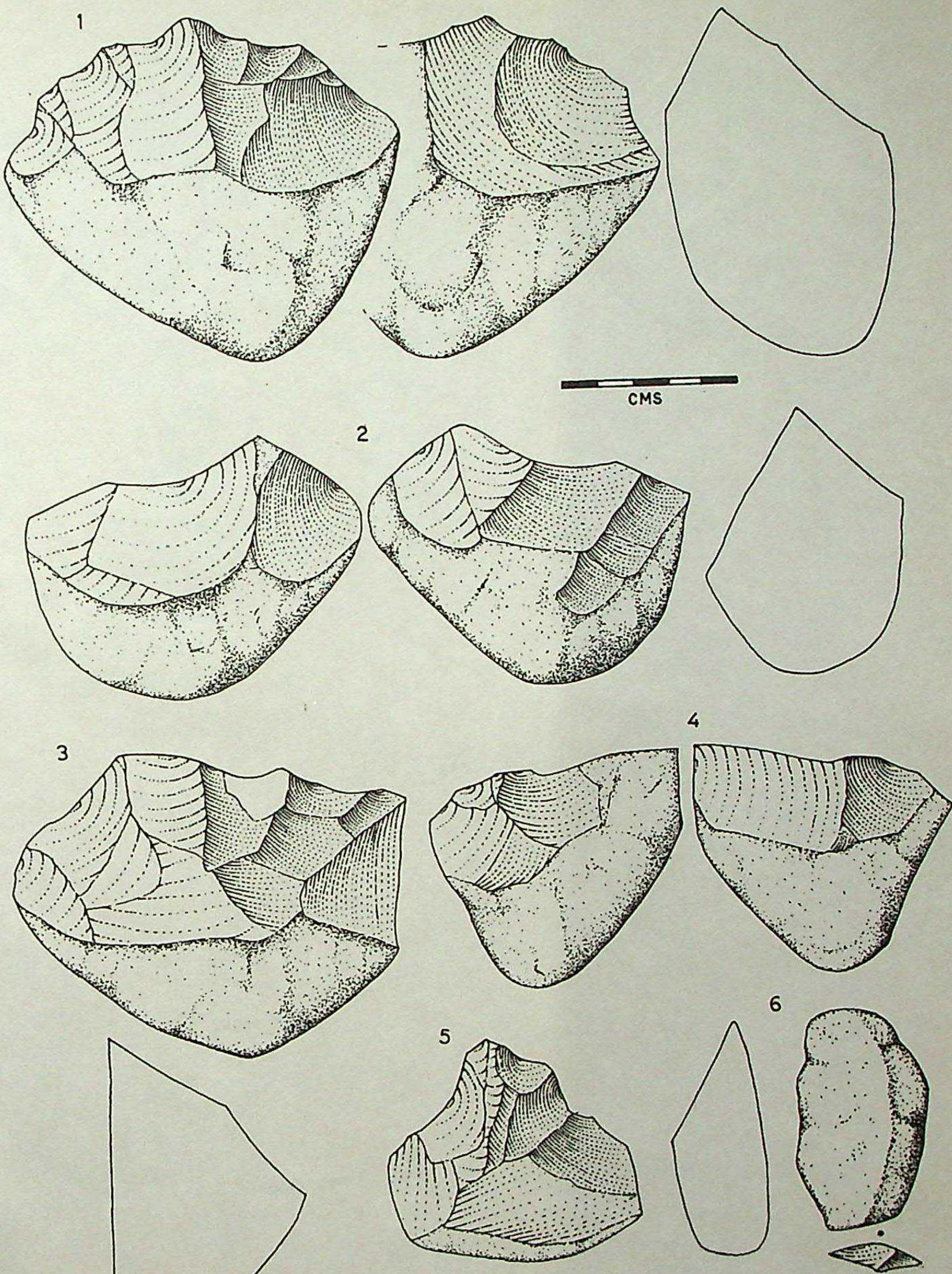
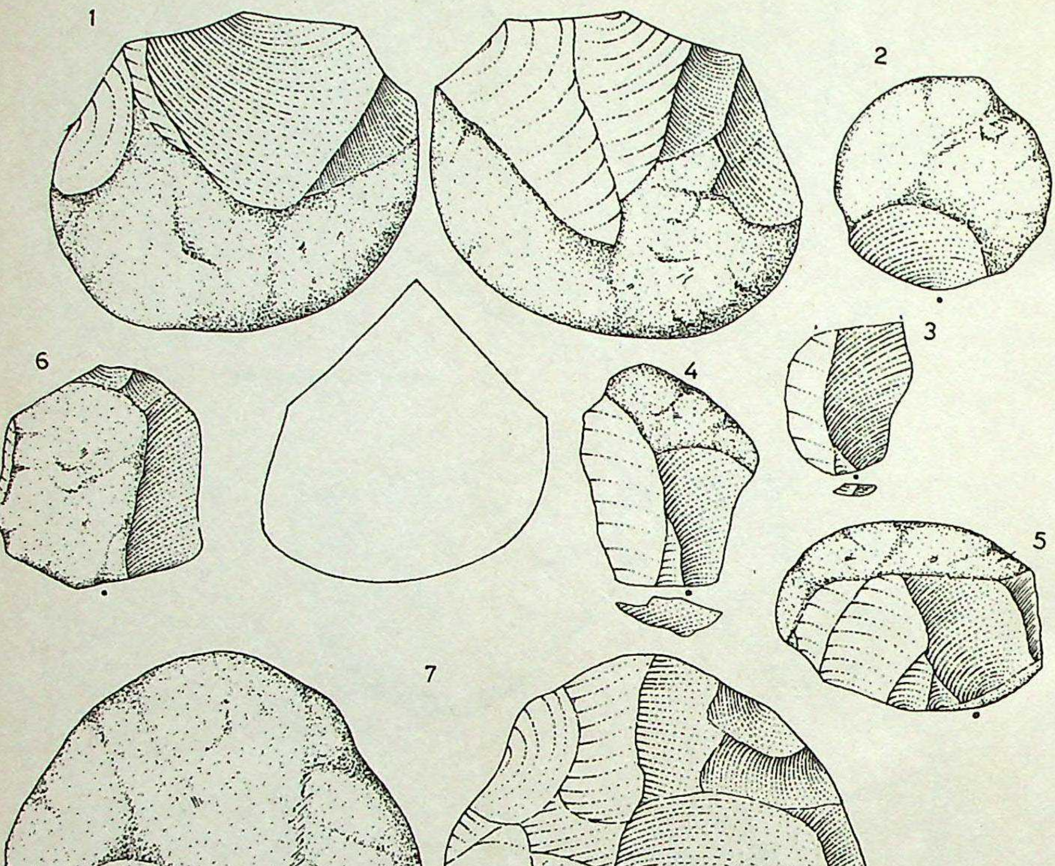


figure 21

VADAMADURAI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CMS

figure 22

State Museum Lucknow

Agam Kala Prakashan Delhi